# DIESEL and GAS ENGINE PROGRESS

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES

FIVE DOLLARS PER YEAR

OCTOBER, 1961

FIFTY CENTS PER COPY

VOL 2

10

# TEXACO DIESEL DATA

## HELPFUL HINTS ON CHOOSING THE RIGHT LUBRICANT FOR YOUR DIESEL

Using a lubricant that's exactly right for your diesel will help avoid one of the main causes of diesel downtime. The deposits formed by the wrong lube oil on valves, in cylinder ports, piston ring grooves and in the combustion chamber can lead to serious, and expensive, repair problems.

### Where to use detergent (heavy duty) oils

Small automotive type diesels should be lubricated with additive-type heavy duty oils. Crankcases are small, and frequent draining removes from the engine the contaminants entrained in the oil. For certain types of engines burning high sulfur fuel (1% sulfur or more), super-duty oils give best lubrication.

Straight naphthenic oil is frequently used for large diesel cylinders, because the advantages of heavy duty oils are usually not so apparent as they are in higher speed engines. Under severe operating conditions, however, the separately-lubricated cylinders of large engines are often lubricated with heavy duty oils.

Detergent oils are not ordinarily needed for the comparatively light duty existing in separately lubricated crankcases and bearings. These crankcase lubricants are often centrifuged for purification, and dispersant characteristics in an oil cause it to resist centrifuge clarification.

In such installations, a straight mineral oil can be kept in excellent condition almost indefinitely, provided an efficient purifying device is installed, to remove fuel soot and other contaminants as fast as they form. Straight mineral oils are particularly recommended for the crankcases of engines with water-cooled pistons, or trunk-type pistons where the crankcase oil is contaminated by appreciable amounts of water or fuel soot.

### What determines viscosity requirements

Bearing temperatures are important because the viscosity of an oil changes greatly with temperature. Experience shows that the viscosity of the oil for the average internal combustion engine should be between 250 and 400 seconds Saybolt Universal at 130°F. If the engine isn't equipped with oil temperature control, and crankcase temperatures vary, it's desirable to provide the proper oil for the highest temperatures, even though this results in higher viscosity than necessary at the lower temperatures.

In slow and medium-speed engines with single-system lubrication, where only one lubricant can be used, each installation should be considered individually. In determining viscosity for these types of engines, some compromise is necessary between the requirements of the bearings and the cylinders. Here the viscosity of the oil should ordinarily be between 55 and 85 seconds Saybolt Universal at 210°F.

### Residual fuels present special lube problems

Selecting a lubricant for stationary and marine diesels burning residual or residual-distillate fuels takes special attention, because these fuels usually contain more sulfur compounds than do distillate diesel fuels. When the fuel is burned, these sulfur compounds can react to form materials that are corrosive to liners and ring metal. Such attack shortens the potential service life of these parts.

To combat this corrosive attack, special alkaline reserve type oils have been developed which contain additives that react with corrosive combustion products. This reaction greatly reduces metal removal by corrosion, and extends the useful life of rings, cylinder liners and other engine parts.

Whenever high sulfur content fuels are used, or when conditions of service of the diesel engine lead to corrosion of engine parts, it's recommended that you use these special alkaline reserve type oils.

The only difference between these two pistons was the lube oil. Both ran the same length of time, in identical engines, but heavy deposits on piston at left show that the lube oil chosen was not exactly suited to the fuel and type of service.

### Engine performance the most dependable criterion

All the points we've made in this article are based on actual in-use experience with specific engines using specific lubricants. In-use tests are the most reliable way to find out if an oil is compatible with an engine, because, unfortunately, there are no simple lab tests that can tell you in advance whether an oil is suitable for a particular engine. That's why it's a step in the wrong direction to set up purchasing specifications calling for a certain gravity, flash and fire point and viscosity index.

When choosing an oil, therefore, you should consult a lubricant supplier who has a wide range of oils to offer, and who knows how each type will perform in a specific engine.

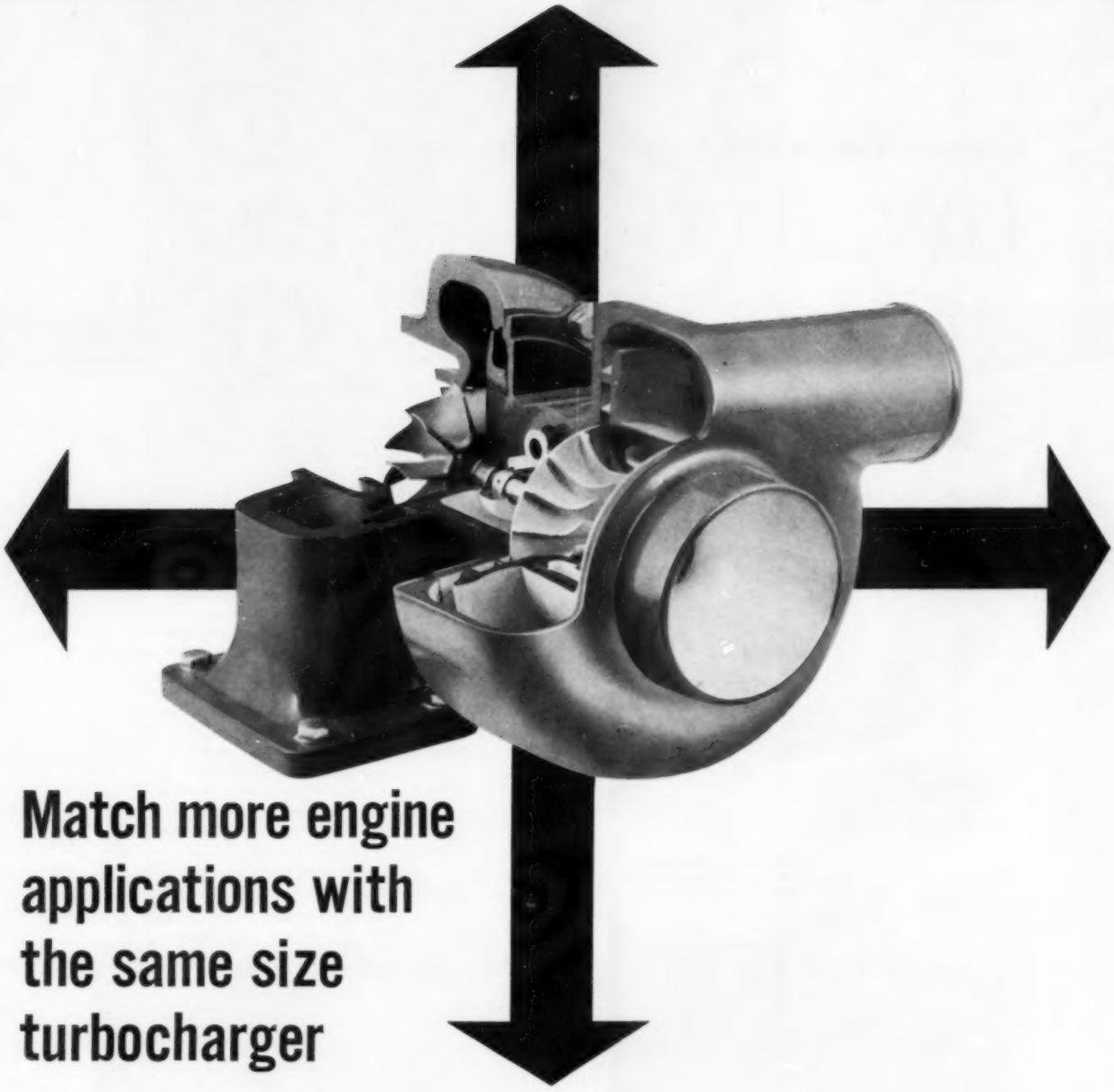
**Fitting the oil to the engine is a job for a man who knows about both. Texaco has many years' experience fueling and lubricating diesel engines of all sizes, in all types of operations. If you're having a problem with diesel fuels or lubricants, contact Texaco Inc., 135 East 42nd Street, New York 17, New York.**

Tune In: Huntley-Brinkley Report, Monday Through Friday—NBC-TV

TEXACO

*Throughout the United States*

*Canada • Latin America • West Africa*



# Match more engine applications with the same size turbocharger

**Interchangeability** of proven AiResearch turbocharger components provides the perfect match to a wide variety of engine applications... without changing turbocharger frame size.

Thus, the same turbocharger serves many different horsepower, rpm and torque rise requirements. This reduces engineering costs and eliminates many problems which might arise from changing turbocharger shape or dimensions.

The need for a large inventory of different size turbochargers is also eliminated. A few simple components now do the job. The basic rotating group within the turbocharger, however, remains unchanged... thereby achieving still further economies.

These advantages extend to the complete line of AiResearch high performance, low cost turbochargers for reciprocating engines in the 50-2000 hp range. Your inquiries are invited.

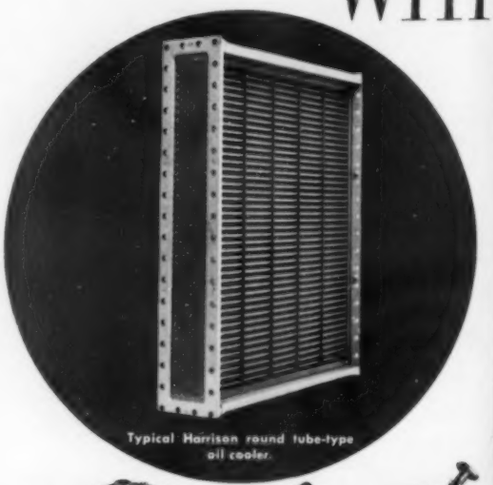
GARRETT

**AIRESEARCH INDUSTRIAL DIVISION** • *9225 South Aviation Blvd., Los Angeles 45, California*

*Designers and manufacturers of turbochargers and specialized industrial products*

General Motors Reliability in Action...

# COAL AUGER BORES DEEP WITH COOL POWER



Typical Harrison round tube-type oil cooler.

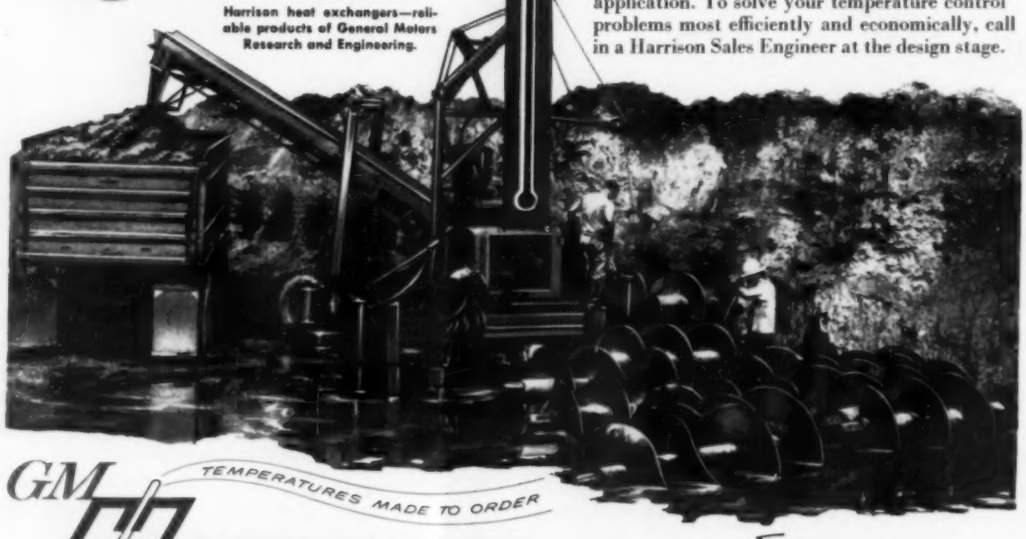
Harrison heat exchangers—reliable products of General Motors Research and Engineering.

## GM HARRISON OIL COOLERS PERFORM RELIABLY IN TOUGH DIESEL-POWERED MINING OPERATION

When rock and earth overburden becomes too great for economical coal-stripping in this Ohio mine, an ingenious auger works in a deep trench to "bore" out the coal.

For this rugged job, a GM Diesel engine supplies the power. And a Harrison heat exchanger—built under the most rigorous standards of reliability—keeps the engine oil cool. This reliability—"measurable excellence"—is accurately maintained by a system of scientific controls that cover every phase of product design, development and production. Result: Harrison heat transfer products that perform their functions exactly *right*.

You can get this Harrison reliability in a wide range of basic types of heat transfer construction—a complete line of designs which assures the *right* heat exchanger for every application. To solve your temperature control problems most efficiently and economically, call in a Harrison Sales Engineer at the design stage.



GM HARRISON — TEMPERATURES MADE TO ORDER

AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

Free — For an informative 48-page brochure on the complete Harrison line . . . write to Department 902

# DIESEL AND GAS ENGINE PROGRESS

REX W. WADMAN — *Editor and Publisher*

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES

BRUCE W. WADMAN — *Executive Vice Pres.*
ROBERT E. SCHULZ — *Vice Pres., & Managing Editor*
ANTHONY A. ALBERTE — *Associate Editor*
JAMES W. BROWN — *Midwest Editor*
ELTON STERRETT — *Southwest Editor*
JANE A. JURICK — *Circulation Manager*


## CONTENTS FOR OCTOBER, 1961


Cummins' New Compact, Vee Truck Diesels ..... 17
4000 HP Locomotives with Diesel Hydraulic Drive ..... 20
Precise Power for Zeus Radar ..... 22
Rail Ferry Has Turret Steering ..... 24
Laboratory Sampling Program Aids Industrial Engine Coolant Control .... 26
Detroit Diesel's Line of Multifuel Engine ..... 28
Dual Fuel Engines Serve Pipe Line ..... 30
Allis-Chalmers' New Engine Plant ..... 32
Hypereutectic Silicon Alloy for Pistons ..... 35
Onan's New DJ Series of 5 to 24 HP Diesels ..... 36
Two Cats in a Bank ..... 39
Modernization and Maintenance Make the Big Difference ..... 40
Diesels in Chevy's Medium Duty Line ..... 42
Special Oil Purifier Enters Market ..... 43
New Shop for Injector Rebuilding ..... 43
Gas Turbine Progress ..... 44
Turbine-Compressor for Nuclear-Electric Unit ..... 45
Carolina Utility Installs 11,250 KW Packaged Turbine Plant ..... 46
Quarry Uses "Rip and Push" Operation ..... 59



MEMBER OF BPA

Business Publications Audit of Circulation, Inc.

DIESEL AND GAS ENGINE PROGRESS for October, 1961, Vol. XXVII, No. 10. Published Monthly by Diesel Engines, Inc., 1701 W. Wisconsin Ave., Milwaukee 3, Wisc. Phone DIvision 4-5355. Subscription rates are $5.00 for U.S.A. and possessions. All other countries $7.50 per year. Subscriptions may be paid the London Office at £2-12s-6d per year.

DIESEL AND GAS ENGINE PROGRESS is indexed regularly by Engineering Index, Inc. and is available in microfilm editions from University Microfilms, Inc., Ann Arbor, Michigan.

MEMBER OF MPA

Magazine Publishers Association, Inc.

**EXECUTIVE OFFICES**
10850 Riverside Dr.
North Hollywood, Calif.
TRiangle 7-5331

**EDITORIAL OFFICES**
1701 W. Wisconsin Ave.
Milwaukee 3, Wisc.
Division 4-5355

**BUSINESS OFFICES**

MILWAUKEE 3:
Bruce W. Wadman
1701 W. Wisconsin Ave.
Division 4-5355

LONDON E.C. 4:
G. L. Fatherstonhaugh
St. Paul's Corner
Ludgate Hill
City 5318

**FIELD EDITORS**

HIALEAH, FLA.:
Edwin Dennis
250 W. 50th St.
TUxedo 8-2188

WALNUT CREEK, CALIF.:
F. Hal Higgins
90 Grand View Place
YEllowstone 4-9531

HOUSTON 18, TEXAS:
Donald M. Taylor
1345 Chamboard Lane
OVerland 6-1127

HOUSTON 6, TEXAS
Elton Sterrett
1948 Lexington
JAckson 2-9088

JEFFERSON CITY, MO.:
L. H. Houck
400 Linden Dr.
Phone: 6-2993

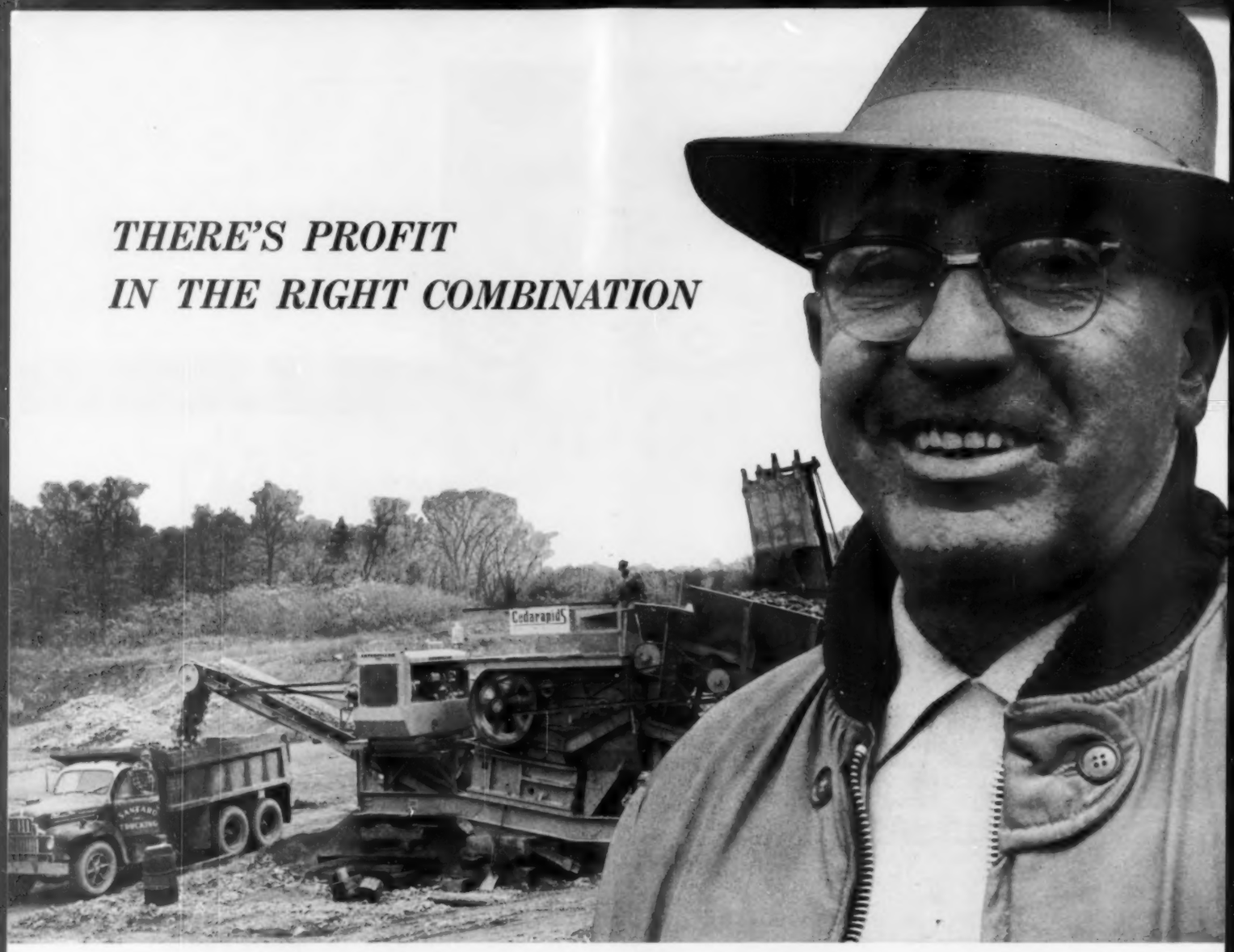
LOS ANGELES 46:
James Joseph
8421 Melrose Ave.
OLive 3-4542

DETROIT 39, MICH.:
James W. Brown
13936 Kinloch Road
KEnwood 2-1545

FRONT COVER ILLUSTRATION

Two White Superior 6G-825 gas engines, each rated 500 bhp at 900 rpm operate on free sewage gas to drive Reed-Standard blowers at Hamilton, O., treatment plant.

# *THERE'S PROFIT IN THE RIGHT COMBINATION*




## MODERN CAT DIESEL ENGINES AND CEDARAPIDS PORTABLE AGGREGATE PLANTS

"Cheaper by the ton." That's Mike Santaro's number one reason for powering this versatile Cedarapids Portable Primary Crusher with a Caterpillar D342 Diesel Engine. It lowers his aggregate costs, lets him sharpen his bidding pencil without cutting into sensible profit margins. Santaro's firm, Tarosan Construction Co., Inc., uses this mobile unit to crush bank-run gravel to a 3½ inch maximum for Syracuse, N.Y., area jobs.

Trim, modern Cat Diesels look and act as if they were designed specifically for portable crushers. It's not true, of course. These engines power many types of new equipment: trucks, draglines, shovels, locomotives, drill rigs, pumps, compressors, asphalt plants, workboats, road rollers, ditchers and earthmovers of every size.

Their trim lines make them the logical choice in *portable* crushing equipment where engine weight, size and horsepower are decisive factors. The D342 is rated an efficient 260 HP @ 1300 RPM (intermittent). It is turbocharged as an integral part of the engine's design for greater horsepower per pound and works efficiently on low-cost fuels.

Crushers churn up a lot of dust but Caterpillar's heavy-duty, dry-type air cleaner and pre-cleaner remove 99.8% of the air-borne dirt. Owners of Cat-powered Cedarapids crushers get maximum performance with minimum maintenance . . . and their equipment is backed by Cedarapids' worldwide dealer organization—the Cat Engine by more than 800 Caterpillar Dealers all over the free world.

You can take advantage of the combination of diesel economy and Caterpillar reliability in the equipment you manufacture. Write today for specifications on the entire Caterpillar Engine line.

### CONSIDER THESE QUESTIONS IF YOU BUILD PRODUCTS REQUIRING ENGINE POWER

- Are components of your product easy to sell because of customer acceptance?
- Does the entire product (including the engine) receive outstanding parts and service backing?
- Does the product's engine offer a quality label that is so important to user satisfaction and repeat sales?
- Does the engine in your product have a reputation for high trade-in value?

Facts about Caterpillar. Caterpillar Engines have enjoyed a reputation of high quality for more than 30 years. 5000 Caterpillar Dealer field trucks in the U.S.A. alone can provide quick service when needed. Caterpillar Engines have a reputation for high trade-in value and low total cost of owning.

# CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

# Reduce maintenance...increase equipment life

with

# AIR-MAZE FILTERS

## There's one to meet every need!

**AIR-MAZE AUTOMAZE**—the automatic, self-cleaning impingement type filter for heavy-duty use. A constantly moving curtain of viscous-coated double filter panels traps air-borne particles. Panels are thoroughly cleaned and recoated by passing through an adhesive bath. Filters consist of layers of crimped galvanized steel wire screens of selected meshes. Available in all capacities with or without weather louvres or plenums. Air or electric drive optional.

**AIR-MAZE "DA" DRY-TYPE FILTER**—laboratory tested for better than 98% efficiency with particles of 2 micron mean diameter, practically 100% with particles 5 microns or larger. Corrosion resistant, designed for use up to 6650 cfm. Filter media is heavy, deep-pleated wool felt flanked by sturdy galvanized steel cloth. Element can be cleaned with a commercial solvent or by blowing off with compressed air.

**AIR-MAZE OIL BATH FILTER**—the low-pressure-loss way to oil wash intake air. Offers a distinct engineering advancement because it provides low static pressure drop without requiring any outside energy. Removes practically all fine abrasives and dirt! No moving parts, nothing to wear out, easier servicing! Made of rugged, heavy gauge steel coated with enamel. Available in capacities up to 20,000 cfm.

*Write for latest bulletins on AIR-MAZE complete line of air and liquid filters and intake silencers for all types of large engines and compressors.*

**AIR-MAZE DIVISION**
CLEVELAND 28, OHIO
ROCKWELL-STANDARD CORPORATION

# ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

## CAN YOU PICK THE RINGS WITH 37,000 HOURS' WEAR?

UNRETOUCHED PHOTOGRAPH

Take a close look at this engine piston that's just been pulled for routine inspection at the generating plant of Illinois Rural Electric Co. Then see if you can pick the rings with 37,000 hours of wear.

No matter which ones you picked, you're right! The *complete set* of Cook rings has completed 37,000 hours of operation. But you wouldn't know it.

What's the reason for the unusual wearing qualities of this set? Special, expensive *top* rings? No, they're standard Cook sealing rings. The reason is to be found in grooves number 4 and 5 — COOKTITE sealing rings. Cooktite rings completely seal the ring gap, ring groove, and cylinder wall, and greatly reduce the excessive load normally carried by ring number 1.

Maybe Cooktite is the solution to your ring problem.

### HAVING TOP RING TROUBLE?

If you have had trouble with your top piston rings (excessive groove wear, groove damage, ring breakage, etc.) you won't need to be convinced that the top ring carries from 50 to 80% of the sealing load. The solution that is saving dollars for many companies is the installation of a Cooktite sealing ring, or rings, in the lower grooves.

In an engine with a compression pressure of 500 psi and a firing pressure of 1,000 psi, a Cooktite ring will reduce the pressure differential on the top ring from a trouble-causing 750 psi to an easily-handled 500 psi. Ask a Cook representative to show you where Cooktite rings can work for you.

### SEND FOR FREE 8-PAGE BOOKLET

Improve your engine's performance and keep it high for longer periods by better cylinder sealing. You can get a free copy of this informative technical study by writing C. Lee Cook Division, Dover Corporation, 940 South 8th St., Louisville 3, Kentucky.

C. LEE COOK

DIVISION OF DOVER CORPORATION

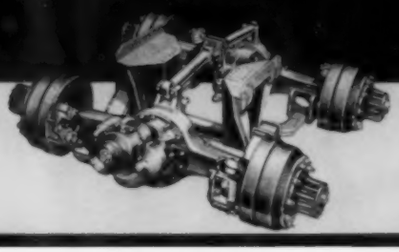
*Rings and Packings Since 1888*

# there's a ROCKWELL-STANDARD Driving Tandem for every kind of service

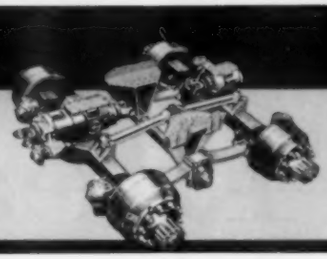
First developed by Rockwell in 1918, driving tandems offer four important advantages over single driving axles... *greater legal payload... greater traction... better flotation... smoother riding!*

Today, only Rockwell-Standard offers a complete line of driving tandem axles to meet every on-or-off highway need. Capacities are available in a range from 22,000 to 150,000 pounds—with axle ratio selection exceeding anything offered elsewhere in the industry.

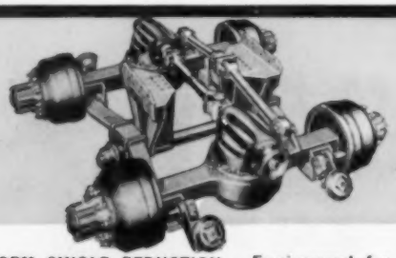
One of the four types of driving tandems below is ideally suited for your particular requirements:



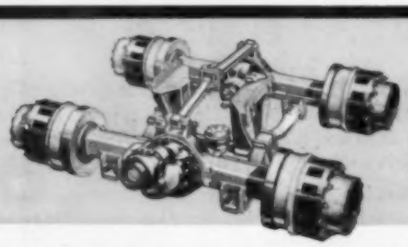
**HYPOID SINGLE REDUCTION** • Engineered for minimum weight and cost • Husky hypoid gearing for maximum gear strength • Axle ratios up to 8.6 to 1 • Nine models with capacities to 46,000 pounds.



**HYPOID-HELICAL DOUBLE REDUCTION** • Engineered for universal heavy-duty operations • Balanced hypoid-helical double reduction gearing • Wide selection of ratios • Six models with capacities up to 65,000 pounds.



**WORM SINGLE REDUCTION** • Engineered for simplicity of design and long life • Worm gear may be reversed to increase operating life • Four models with capacities up to 50,000 pounds.

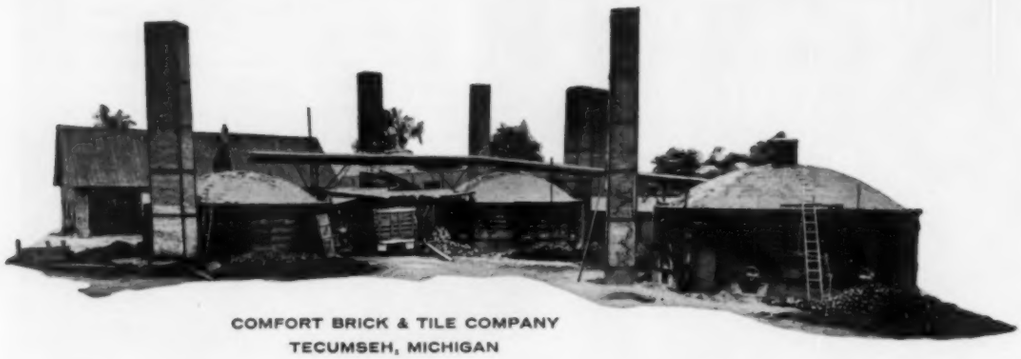


**FULL PLANETARY DOUBLE REDUCTION** • Engineered for extra heavy-duty operations • Planetary reduction is at wheel end for greatest mechanical advantage • Capacities up to 150,000 pounds.

*Products of...* **ROCKWELL-STANDARD CORPORATION**

Transmission and Axle Division, Detroit 32, Michigan

# Service... from a



COMFORT BRICK & TILE COMPANY
TECUMSEH, MICHIGAN

# 24 year old diesel!

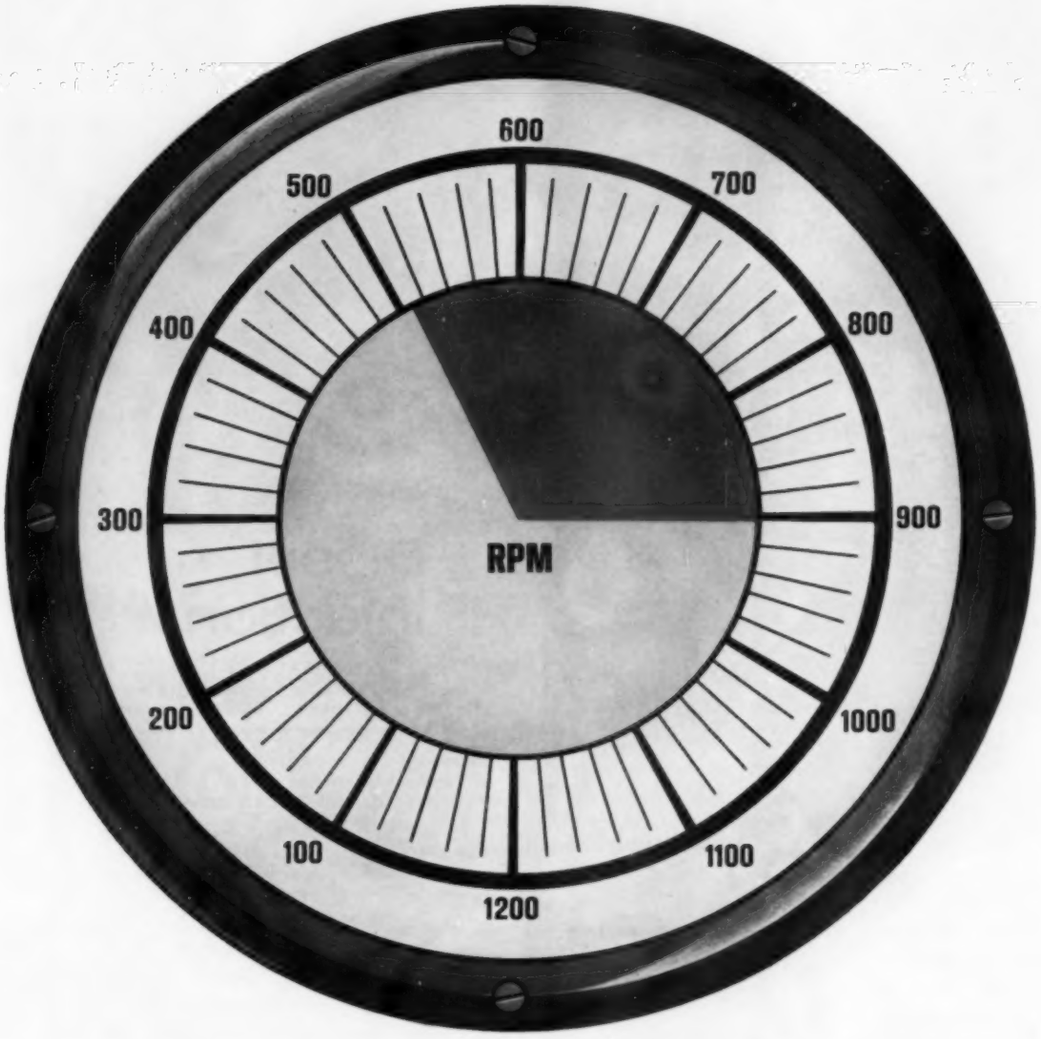
A 24 year old Diesel is still serving the Comfort Company. And Company President Ralph Comfort has no intention of replacing it. "I put that diesel to work back in 1936 and it's still going strong today." He adds, "We sure owe a lot to Cities Service for the performance we're getting from our equipment!"

Comfort has relied on Cities Service for more than 38 years! The company produces 4,000,000 feet of clay drainage pipe annually, and it takes plenty of diesel power to keep the factory machinery going. Cities Service C-500 Motor Oil is used in all the diesel engines, Cisco Compound for lubricating open gears, Pacemaker Oil for hydraulic systems and Trojan H Grease as a general lubricant.

Cities Service C-500 Oils are designed for diesels using high sulfur fuels. These oils prevent the sludge, clogging and waste of cold engine operation . . . provide superior hot engine protection, too. You can depend on Cities Service to keep your diesel running better, longer! For information, call your nearest Cities Service office, or write: Cities Service Oil Company, 60 Wall Street, New York 5, N. Y.

RALPH COMFORT AND SON

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS




# EACH ADDED RPM CAN SAVE YOU $775

Seven ALCO 251 diesel electric sets for an Advanced Research Projects Agency installation in the Pacific will each generate 1500 kw at 900 rpm. Their medium speed will save about $300,000 per unit over low-speed engines. Factors in this lower cost: suitability to mass production and pre-packaging, lower transportation and erection costs, less complexity in electrical equipment. Can you use savings like these in your stationary diesel operations? ALCO Products, Inc., Dept. 1216, Schenectady, N.Y.

*Product quality comes first*

**ALCO DIESEL ENGINES**

# Element of Diesel Injection

For each engine cylinder a pump cylinder of its own – that is the basic principle of the BOSCH injection pump. The pump element actually becomes a Diesel injection element.

Whether one, two, three, four, six, eight or twelve cylinder Diesel engine, each engine cylinder will be supplied with the correct dose of fuel at the correct moment through its "own" pump element.

Proof for the accuracy and the advantages of this system discovered almost 40 years ago is evidenced throughout the world by its millionfold application:

- Adjustable, constantly accurate dosing of the fuel quantity injected into each engine cylinder.
- Standardized component principle, applicable to Diesel engines of any number of cylinders.
- Precision-made on production lines, offering important technical advantages at low cost.
- Well-organized after sales service throughout the world, based on a minimum of parts subject to wear.

EP 461 B

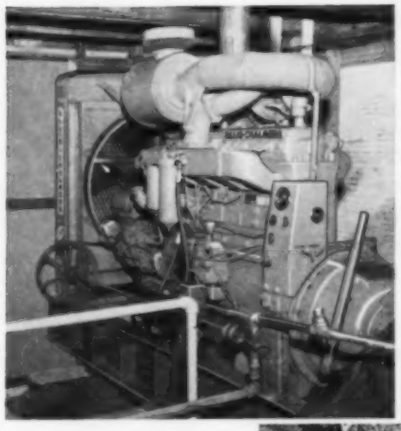
# ROBERT BOSCH

## Injection Pumps for all Diesel Engines

ROBERT BOSCH CORPORATION • New York City • San Francisco

# That 21000 diesel—

## *"It just plays with the pump!"*



. . . said Joseph L. Fauver of Fauver Bros., La Crosse, Wis., dredging contractors, after repowering their 8-in. dredge pump with an Allis-Chalmers 21000. "It puts 100 yd an hour through 600 ft of pipe on a 25-ft lift—and we haven't seen it smoke yet!

"Our whole operation has increased in efficiency 30 percent. On top of that, we only use half the fuel that we did with the other engine. The 21000 engine takes the same amount of fuel for a 20-hour shift as the replaced engine used in 10 hours."

If you want a diesel with more reserve power, less weight, greater fuel economy, clean-burning and efficient... you want an Allis-Chalmers "Thousand Series" diesel. Your dealer will prove it's your best buy! Allis-Chalmers, Milwaukee 1, Wis.

BC-39

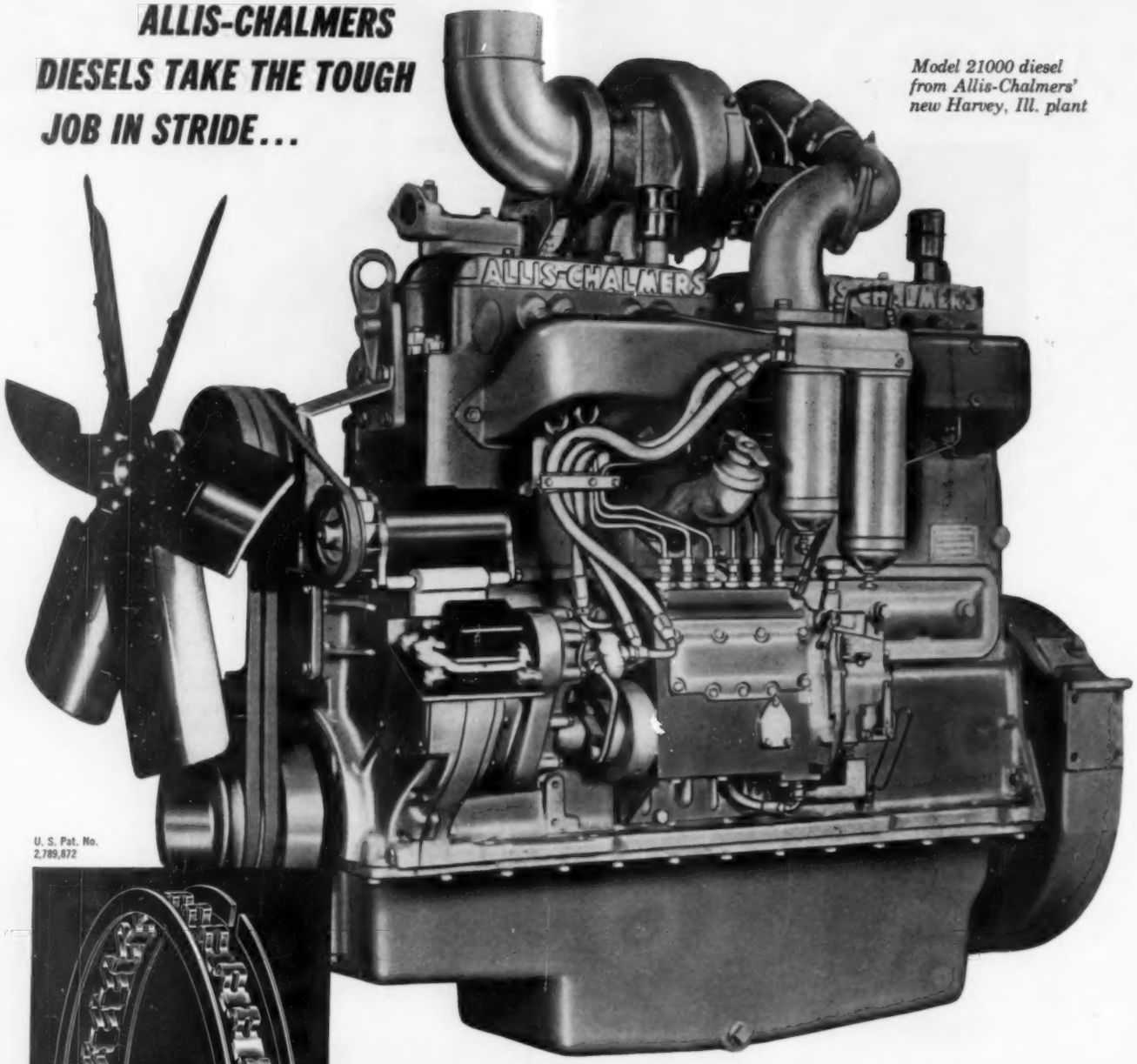
PERFORMANCE PROVED

**ALLIS-CHALMERS**

***POWER* FOR A GROWING WORLD**

## ALLIS-CHALMERS DIESELS TAKE THE TOUGH JOB IN STRIDE...

*Model 21000 diesel from Allis-Chalmers' new Harvey, Ill. plant*




U. S. Pat. No. 2,789,872

## SO DO SEALED POWER STAINLESS STEEL OIL RINGS

'Dozers, scrapers, farm tractors and heavy-duty generators rely on Allis-Chalmers diesels. Reason why is logical. These engines are built to take it. They combine rugged strength and dependability to the *nth* degree.

Sealed Power's Stainless Steel oil ring is factory installed in Allis-Chalmers diesels. It was specified because this ring lives longer in severe service, extends engine life and cuts maintenance costs.

Sealed Power's patented, proven end-abutment design combines with "magic" Stainless Steel to control and conserve oil better than any other oil ring.

As a major supplier of Allis-Chalmers, Sealed Power shares Allis-Chalmers' pride in its ultra-modern new plant at Harvey, Illinois. It is the latest example of Allis-Chalmers' continued progress and faith in the future. Sealed Power Corporation, Muskegon, Michigan.

**Sealed Power**

The Stainless Steel oil ring is in Allis-Chalmers service sets, too.

# COSTLY DUST PROBLEM SOLVED BY DRILLING COMPANY WITH PUROLATOR 2-STAGE DRY-TYPE AIR FILTERS

**First-stage Micronic® element** of Purolator 2-stage air filter being replaced by New Jersey Drilling Co. Foreman, Dick Hompesch. One of the nation's biggest drilling outfits, New Jersey Drilling uses Purolator 2-stage filters to protect all its motive equipment.

**Four ruined diesels prompt quick switch to Purolator 2-stage dry-type filters with built-in double protection.**

"A lot of abrasive silica dust passed right through our old single-element filters and completely ruined four drilling-rig diesels," reports Emil McConnel, New Jersey Drilling Co. VP.

"The extra protection offered by a second filter element sold us on the idea of switching to Purolator 2-stage air filters. Performance has been completely satisfactory. These filters now protect all our motive equipment."

**Why Purolator 2-stage filters give complete protection.**

Purolator's 2-stage air filters offer extremely high performance because they contain two Micronic® filter elements — each operating independently. If one element should get out of order, the other keeps on removing 99.98% of all contaminates. Harmful abrasives never get into the engine—no matter how dirty the job.

**Easy, quick maintenance.**

Servicing the 2-stage filter takes only minutes. After housing cover is removed, used element is lifted out and replaced with a new one. First-stage element lasts up to 2,000 hours. Second-stage element should last almost indefinitely.

For complete details on the 2-stage, dry-type air filter, write: Purolator Products, Inc., Dept. 7137, Rahway, N. J.

*Filtration For Every Known Fluid*

PUROLATOR

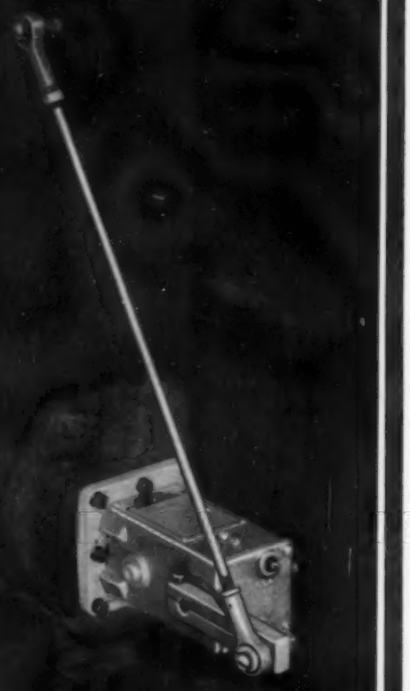
PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, CANADA

# ACCURATE CONTROL for Small Engines

## MODEL LE GOVERNOR

## World's Smallest ISOCHRONOUS GOVERNOR



Now available — world's smallest hydraulic isochronous governor — the Curtiss-Wright Marquette Model LE. This is not only the world's smallest but also the world's finest governing device for diesel, gasoline or gas engines. Measurements of the basic governor are 2" square by 4" high, with a total weight of 1½ lbs. Various base adaptations are available which permit application of the governor to engines requiring up to 18.6 lb.-in. torque for operation of the fuel control system.

Design and production engineering plus high standards of manufacturing and quality control provide accurate governor reliability and long life operation.

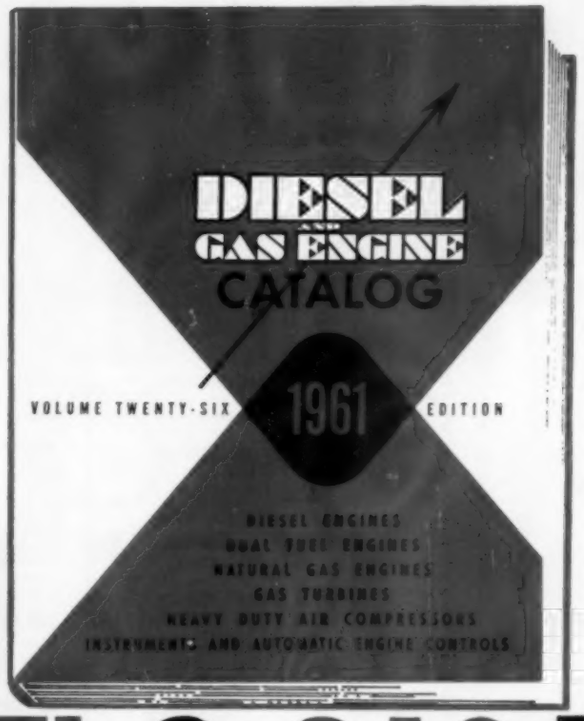
A load and frequency sensing accessory may be incorporated with the governor to obtain precise control of frequencies. Externally adjusted droop is available for parallel operation of units, and an electric motor for remote speed settings.

There is a Curtiss-Wright Marquette Governor that will exactly meet your requirements. Write for descriptive literature on this and other models in the Curtiss-Wright Governor line.

MARQUETTE DIVISION
**CURTISS-WRIGHT CORPORATION**
1145 GALEWOOD DRIVE, CLEVELAND 10, OHIO
Distributed in Canada by Canadian Curtiss-Wright Ltd., Toronto & Montreal, Canada

# AVAILABLE NOW

*New complete information on engines and accessories!*




# 1961 DIESEL & GAS ENGINE CATALOG

If you design, purchase, sell, operate or service diesel, dual fuel, natural gas engines or gas turbines — **Here is important information for you!**

**LOOK AT THE CONTENTS!**

**1. ENGINES**—All major manufacturers of diesel, dual fuel, natural gas engines and gas turbines are represented in multiple page sections. Text is supplemented with specifications, power curves, photographs and sectional views.

**2. TURBOCHARGERS and SUPER-CHARGERS**—This section of manufacturers is detailed and fully illustrated to give complete information on this increasingly important phase of the industry.

**3. TRANSMISSIONS**—The latest information on torque converters, fluid drives, and other modern means of transmitting power are fully described and illustrated in this section.

**4. ACCESSORY EQUIPMENT**—Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.

**5. AIR/GAS HEAVY DUTY COMPRESSORS**—This section deals with heavy duty compressors of all types applicable to all industry and petroleum services.

**6. INSTRUMENTS and AUTOMATIC ENGINE CONTROL**—This section covers just what the title states.

**7. GAS TURBINES**—This section is devoted to the gas turbines currently on the market, both in this country and abroad.

**8. ADVERTISING**—Leading manufacturers of engines, accessories, and services bring out the important features of their products in attractive, easy to read advertisements to further enhance the reference value of the CATALOG.

*Order Yours Now!*

*Still only $10. per copy!*

**Postpaid**

**DIESEL AND GAS ENGINE CATALOG** — **ORDER BLANK**

10850 Riverside Dr., North Hollywood, Calif.

Enter our order for _____ copy(s) of Volume 26, DIESEL AND GAS ENGINE CATALOG.

Check is enclosed ☐ Bill us ☐

$10.00 per copy (plus state sales tax when delivered in California). When ordering from Sterling Areas, remit £4-0-0 to DIESEL PROGRESS, St. Paul's Corner, Ludgate Hill, London, E.C.4

NAME _____ POSITION _____

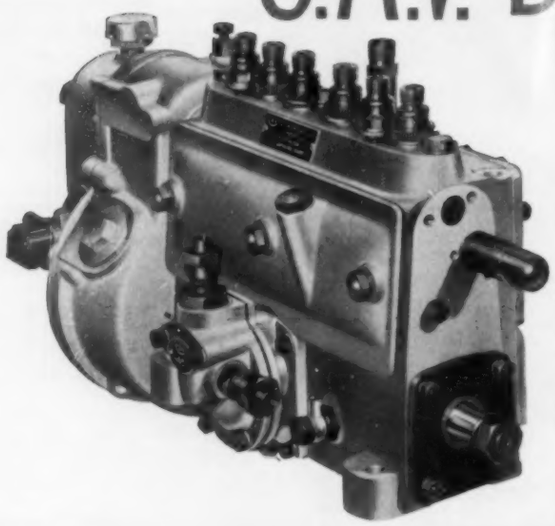
COMPANY _____

BUSINESS CLASSIFICATION _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

# C.A.V. DIESEL SERVICE SPECIALISTS IN U.S.A. AND CANADA



## U.S.A.

**ALABAMA**
Birmingham
Mobile

**ARIZONA**
Phoenix

**ARKANSAS**
De Witt
North Little Rock

**CALIFORNIA**
Bakersfield
El Centro
El Monte
Fresno
Long Beach
Los Angeles
San Diego
San Francisco
Wilmington

**COLORADO**
Denver

**DELAWARE**
Milton

**FLORIDA**
Jacksonville
Orlando
Miami
Tampa

**GEORGIA**
Atlanta

**IDAHO**
Pocatello
Twin Falls

**ILLINOIS**
Chicago

**INDIANA**
Indianapolis

**IOWA**
Des Moines

**KANSAS**
Colby
Garden City
Great Bend
Grinnell
Hutchinson
Plainville
Salina
Wichita

**KENTUCKY**
Louisville

**LOUISIANA**
Baton Rouge
Lake Charles
Morgan City
New Iberia
New Orleans
Shreveport

**MARYLAND**
Baltimore

**MASSACHUSETTS**
Boston
Springfield

**MICHIGAN**
Detroit
Grand Rapids
Ishpeming
Lansing

**MINNESOTA**
Hibbing
Minneapolis

**MISSISSIPPI**
Jackson
Meridian

**MISSOURI**
Kansas City
St. Louis

**NEBRASKA**
Gordon
Lincoln
McCook
North Platte
Omaha

**NEW MEXICO**
Albuquerque

**NEW YORK**
Buffalo
Broooklyn
Long Island
New York

**NORTH CAROLINA**
Charlotte
Raleigh

**NORTH DAKOTA**
Fargo
Minot

**OHIO**
Akron
Cincinnati
Cleveland
Dover
Toledo

**OKLAHOMA**
Enid
Oklahoma City
Ponca City

**OREGON**
Portland

**PENNSYLVANIA**
Philadelphia
Pittsburgh

**SOUTH DAKOTA**
Winner

**TENNESSEE**
Chattanooga
Knoxville
Memphis
Nashville

**TEXAS**
Amarillo
Beaumont
Corpus Christi
Dallas
Houston
Odessa
San Antonio

**UTAH**
Salt Lake City

**VIRGINIA**
Norfolk
Richmond
Salem

**WASHINGTON**
Seattle
Spokane

**WISCONSIN**
Milwaukee
Sun Prairie

## CANADA

**ALBERTA**
Calgary
Edmonton
Lethbridge
Medicine Hat

**BRITISH COLUMBIA**
Vancouver

**MANITOBA**
Winnipeg

**NEW BRUNSWICK**
Fredericton

**NOVA SCOTIA**
Halifax
Liverpool

**ONTARIO**
Brockville
Cornwall
London
Ottawa
Pembroke
Sudbury
Toronto
Thornhill

**QUEBEC**
Montreal
Quebec

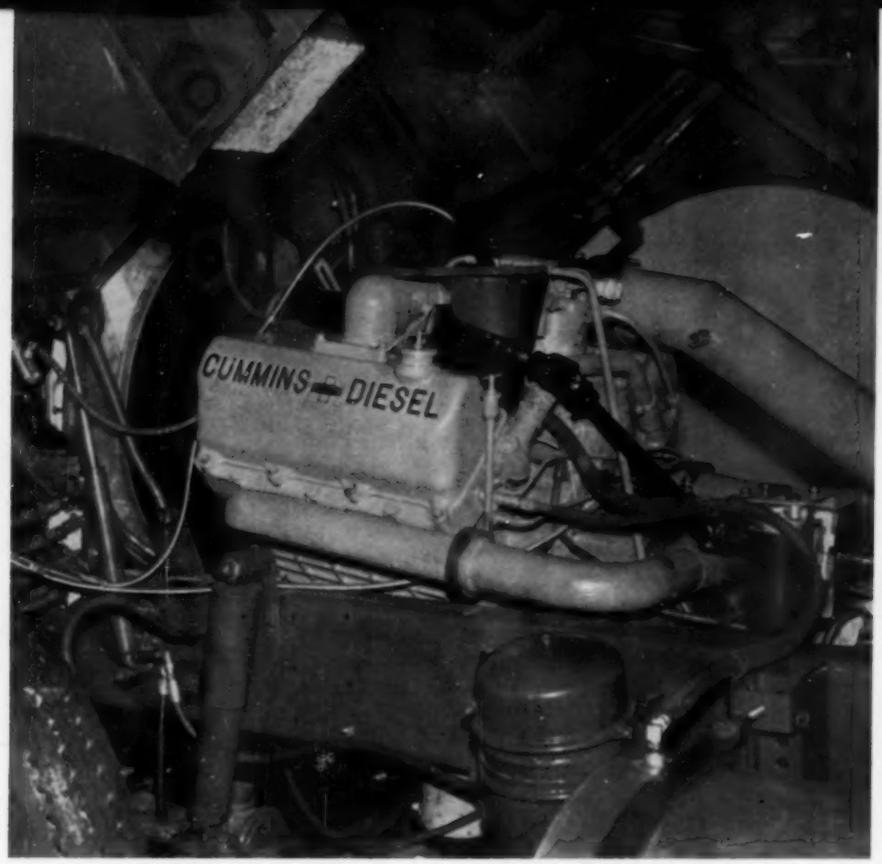
**SASKATCHEWAN**
Regina
Saskatoon

*The World's Largest Manufacturers of*

**FUEL INJECTION EQUIPMENT**

*For full list of Service Agents write to:*
**Fuel Injection Equipment Division of**
**LUCAS ELECTRICAL SERVICES, INC.**
**Head Office:** 501 West 42nd Street, New York 36, N.Y.
**Sales Office:** 14820 Detroit Avenue, Cleveland 7, Ohio
**Factory Branches:** Los Angeles, San Francisco, Seattle, Denver, Chicago, Houston, Jacksonville, Boston, Baltimore
**JOSEPH LUCAS (CANADA) LTD.**
**Head Office:** Toronto
**Factory Branch:** Montreal

AP 130




New Cummins 200 hp, six cylinder Vee in COE tractor. Diesel gives good accessibility and weight reduction affords additional payload.

# CUMMINS' NEW COMPACT, VEE TRUCK DIESELS

## V6 and V8 Engines for Highway Service Have Advanced Design Concept in Diesel Field, Conservative Ratings, and Excellent Performance

*By* BRUCE W. WADMAN

COLUMBUS, Indiana—August 17, 1961—Today I had a close look at two new engines at Cummins Engine Co. that represent an important step in the evolution of high speed diesel design and development. Cummins engineers have adapted the 90° vee, big displacement design concept, so popular today in our vee type automobile gasoline engines, to the high speed diesel engine for over-the-road trucking service.

The new engines are four cycle units and the first in a new family of engines that will feature both larger and smaller sizes to be announced in the future. The engines, designated Models V6-200 and V8-265, have identical cylinder sizes with a bore of 5½ in. and stroke of 4⅛ in. The V6-200 is a 90° vee six cylinder engine rated 200 hp at 2600 rpm, with piston displacement of 588 cu. in., compression ratio of 16:1, and weight, with standard accessories of only 1475 lbs., or 7.38 lbs. per horsepower. The V8-265 is also a 90° vee with eight cylinders, rated 265 hp at 2600 rpm, with piston displacement of 785 cu. in., compression ratio of 16:1, and weight, with standard accessories, of only 1800 lbs. or an impressive 6.79 lbs. per horsepower. Both engines are naturally aspirated units.

The dimensions of the two new engines illustrate their very attractive compact size. Accompanying illustrations also give a good comparison of size in relation to heavy duty gasoline engines.

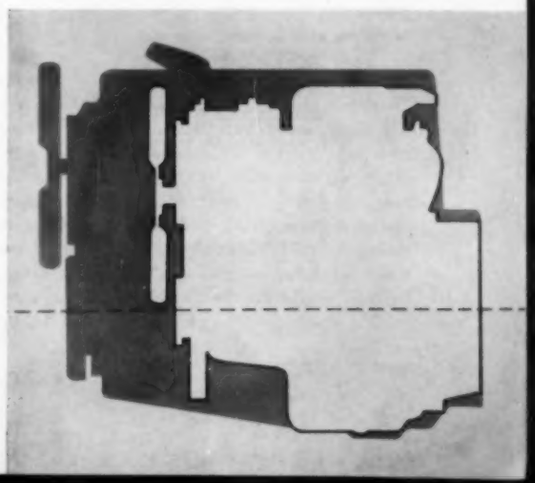
| | Length | Height | Width |
|---|---|---|---|
| V6-200 | 35$\frac{5}{32}$ in. | 39$\frac{17}{32}$ in. | 32¼ in. |
| V8-265 | 42¾ in. | 39$\frac{13}{32}$ in. | 34½ in. |

The illustrated performance and fuel consumption curves show the excellent economy Cummins has achieved with the new engines. With the good horsepower, small size, and outstanding fuel economy, the engines are also conservatively rated for long life service. For example, taking cylinder pressures, the bmep is 103 psi, which is between 6 and 8% below comparable models of the NH series, well known as long life engines. Piston speeds are only 1788 fpm, 15% slower than the NH engines. Exhaust temperatures are 1020° F, from 100 to 150° lower than comparable NH models.

A most significant feature of these new engines is the dramatic narrowing of the weight and size differential between these diesels and heavy duty gasoline engines. The V6-200's weight is within 400-500 lbs. of modern automotive gasoline engines. And it is several inches shorter than gasoline engines. The V8-265 weighs within 500-600 lbs. of heavy duty gasoline engines and allows approximately equal dimensions. Compared to other Cummins diesels, the V6-200 is 39% lighter and 42% shorter than the NHE-195 engine, and the V8-265 is 31% lighter and 29% shorter than the NH-250 engine.

Also, the higher 2600 rpm speed of the engines coupled with their characteristics of high horsepower with lower torque, particularly for the V6-200, allows the use of lighter and shorter transmissions in many applications. The wide speed range of the new engines contributes to performance and application of transmissions with fewer splits. This, according to Cummins engineers can add up to a total weight saving of 1,000 to 1,300 lbs. compared to present Cummins truck installations of the NH engines, when engine and transmission are considered together. That means more payload for the truck operator.

Length and height of new Cummins V6-200 compared to a six-cylinder gasoline engine of 185 hp. demonstrates compact size of these new diesels. Cummins engine is shown in white.



**Front of the V6-200 diesel. Generator and water pump are belt-driven and provision is made for camshaft mounted fan. Note lube oil cooler with finned aluminum cover has been made part of block. Aluminum is also used for oil pan, valve gear cover and other non-stressed parts.**

In commenting on the application possibilities with these new engines, C. R. Boll, Executive Vice President-Marketing at Cummins told us, "Because these engines are shorter in length and offer a lower height profile, the vehicle designer is offered the opportunity to design shorter and more compact tractors to save weight, cost and length. This means extra dividends on vehicle performance and operating cost to the truck operator."

## Design Features

Now that we have examined the performance of the engines, let's take a closer look at major design features and design philosophy. This has been and continues to be a courageous and ambitious development program in successfully designing the 90° vee, big displacement type engine to deliver excellent performance with diesel combustion and loadings. Cummins research and development engineers deserve a lot of credit on the job they are doing with these engines.

When this development program was initially examined, a number of design advantages with the big displacement, 90° V6 and V8 were evident and have carried through nicely in the final design of the engines. The 90° design provides complete balance of both primary and secondary vibration forces in the V8 design and provides an inherently smooth running engine. A 90° three-throw crankshaft used in the V6 provides a well balanced engine and first order vibrations are eliminated, while second order vibrations of the V6 engine are of low magnitude as a horizontal rocking couple and therefore can be isolated from the chassis with commercially available mountings.

Friction horsepower losses are lower than in conventional in-line engines as the result of lower piston speeds and reduction in the number of bearings. The V8-265 has five main bearings and the V6-200 has four main bearings.

Large cylinder bore with big displacement, 90° vee design allowed four valves per cylinder to be utilized and individual intake and exhaust porting for each cylinder to provide for excellent breathing, good volumetric efficiency, and good piston cooling, as well as low fuel consumption.

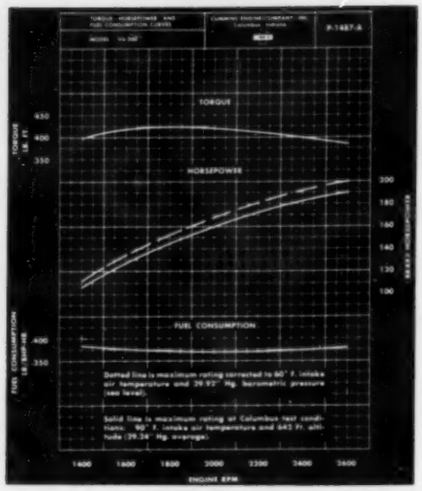
Wide angle vee design allows most major accessories to be installed in the vee for compact package design and ease of accessibility. Single camshaft is also installed in the vee permitting compact and simplified assembly for controlling all valve and injector movement for both cylinder banks. With this design, it was possible to achieve high horsepower in a compact package while still using conventional materials that have been used in previous engines. For example, the cylinder block and cylinder heads are simple alloy cast iron, and pistons are made of conventional aluminum alloy. Finally, this design lends itself well to higher engine rotative speeds while keeping piston speeds low.

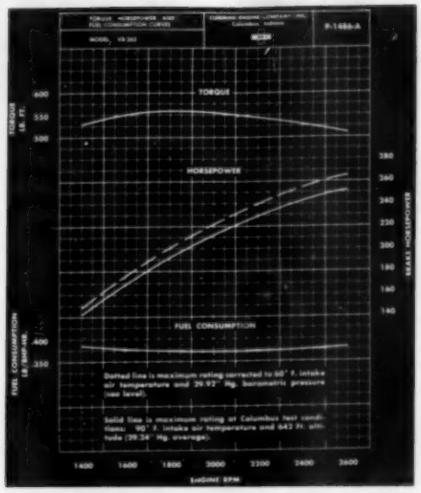
Moving into specific design of major engine parts, let's first scrutinize the fuel injection and combustion system. The Cummins PT fuel pump, featuring the latest improvements like wear-compensating integral flyweight type governor, internal fuel lines and insert type injectors, is gear driven off the accessory drive train at the rear of the engine and is set in the vee. The open chamber combustion system is used with cam-actuated injector, similar to other Cummins engines. Short push rod assembly and steel rocker lever bushings contribute to good fuel injector performance. As stated earlier, there are four overhead valves, two intake and two exhaust for each cylinder. Valve seat inserts are used on all exhaust valves. The valves are actuated through solid push rods and roller type cam followers like the injector. Large intake and exhaust valve area per cylinder permits the good breathing characteristics of the engines.

The cylinder block is conventional alloy cast iron with wet liner type construction. Cross bolt support to main bearing caps is featured for maximum rigidity. The block has been carefully designed to eliminate any material not necessary for adequate strength and rigidity. Cylinder piston-rod assemblies opposite in each bank are carried on the crankshaft side by side. The right bank is inset and the water pump is installed against the front and belt driven for a neat, space saving installation on the engine.

Pistons are aluminum alloy and are interesting, being of very short skirt design and featuring only three piston rings, two compression and one oil ring. Top ring is chrome plated. Pistons are cam ground with full floating bearings. Connecting rods have taper piston pin end to reduce unit pressures through increased bearing area. This permits heavier sections in piston crown. Piston pins are 1¾ in. diameter.

Crankshafts for both engines are conventional type steel forgings with all journals induction hardened with sufficient material for multiple regrinds and are fully counterweighted. Main and connecting




**Power curves for the V6-200 left and V8-265 right. Curves represent performance of engines with fuel system, water pump, lube oil pump and air cleaner. Battery charging generator, compressor, fan and optional equipment not included. Note excellent fuel economy.**

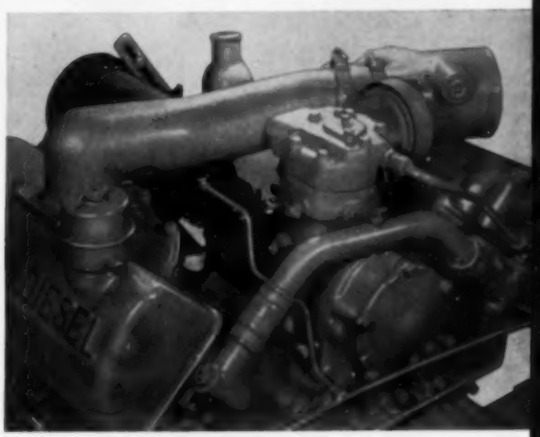
rod bearings are of the precision copper-lead type bearing material. Cylinder heads are alloy cast iron, and there is one for each bank. All fuel lines are drilled passages. Six hold-down capscrews per cylinder provide even pressure on the gasket. And, of course, there are individual intake and exhaust ports for each cylinder cast in.

The accessory gear train is located at the rear of the engine. A Cummins 12 cfm air compressor is driven off the camshaft gear and is located in the vee and the PT fuel pump is driven in tandem through the air compressor. By locating the accessory gear train at the rear, it is located at the point of lowest torsional vibrations, thus increasing life and durability. There is also provision for a camshaft mounted fan at the front of the engines. Mounting the fan in this manner when practicable in vehicle application eliminates fan belts and hubs, reducing maintenance costs. Also, since camshaft speed is one-half engine speed, low horsepower, high volume fans can be used. Generator and water pump are belt driven at front of engine from crankshaft. The V8-265 engine utilizes a vibration damper. The V6-200 does not require a damper because of its extremely short, rigid crankshaft.

The lubricating oil cooler is of a unique design and has been incorporated as a part of the cylinder block. A finned aluminum cover, bolted to the cylinder block, can be easily removed for cleaning the oil cooler. This arrangement effectively isolates cooling water from oil as there are no connections between the two. The lube oil pump is mounted in the bottom of the oil pan and is gear driven. It supplies full pressure lube oil to all bearings. Oil capacity is 3½ gals. for V6-200 and 4 gallons for V8-265.

Cylinder liners are of the wet type, easily replaceable, with "O" ring sealing at bottom of liner. Cooling system is conventional with choker type Vernatherm thermostat located above water pump. Water pump capacity on V6-200 is 65 gpm at 2600 rpm and on the V8-265, 85 gpm at 2600 rpm. Aluminum is used in non-stressed parts like oil pan, valve gear cover, and accessory gear train and flywheel cover for light weight. Air intake manifolds on both engines are of crossover type, one for each bank with 5½ in. diameter inlet into crossover. Exhaust manifold is at outside of each bank with a single manifold for each bank in the V6-200 and single or dual manifolds for each bank in the V8-265.

Cummins has a number of the engines on the road in all parts of the country and performance reports have been good. The two engines are in the horsepower categories to fit into most over-the-road trucking applications throughout the nation, and will be applied industrially and for marine usage also. They should make interesting marine engines. A lot of new production machinery and expanded productive capacity is being installed by Cummins at their Columbus, Ind., plant to produce these new engines. It looks like they will need it.




**Air compressor, PT fuel pump, and 12 volt generator are compactly located within the 90° Vee and provide ready access for servicing.**

**New Cummins V8 is naturally aspirated and delivers 265 hp at 2600 rpm. Internal fuel lines contribute to clean overall appearance.**

**Here is the new Peterbilt 282-M COE tractor—the first designed specifically for the new compact Cummins. Powered by V8-265 diesel, this is one of 35 identical tractors delivered to Pacific Intermountain Express and are designed to pull maximum load high volume 28 ft. double trailers. 265 hp diesel drives through Dana-Spicer 12 speed transmission. Front and rear axles are Rockwell Standard. Farr air cleaner with aspirator is used.**

# 4000 HP LOCOMOTIVES WITH DIESEL HYDRAULIC DRIVE

*By* D. W. BEADLE

IN early July on Austria's rugged Semmering pass, railwaymen from the U.S. and Europe had their first official look at a locomotive that has aroused a great deal of interest—and some apprehension—since the first announcement of its ordering late in 1959.

When the Southern Pacific and the Denver and Rio Grande Western placed an order with West-Germany's Krauss-Maffei AG of Munich for six-4000 horsepower diesel-hydraulic road-haul locomotives—three units apiece—the action created a good deal of comment. Not only were the two roads breaking with the electric-transmission pattern of U.S. diesel railway history, they were asking for a more powerful single-unit diesel locomotive. The choice of a German supplier was surprising, yet that country has been a leader in the application of hydrodynamic drive to railway traction. At the outset of World War II hydraulic drive was firmly established for high-speed diesel railcars and rigid-wheelbase switch engines. With postwar development of high-torque universal-jointed Cardan shafts and right-angle axle drives, together with higher-capacity hydraulic transmissions, the way was open for diesel-hydraulic mainline locomotives of bogie design. Builder of the first V-200s, Krauss-Maffei was a logical place for the SP and Rio Grande to look; to date 98 per cent of the world's diesel-hydraulic locomotives in the over 2000 hp category—264 units—have either been K-M-built or built under K-M licenses.

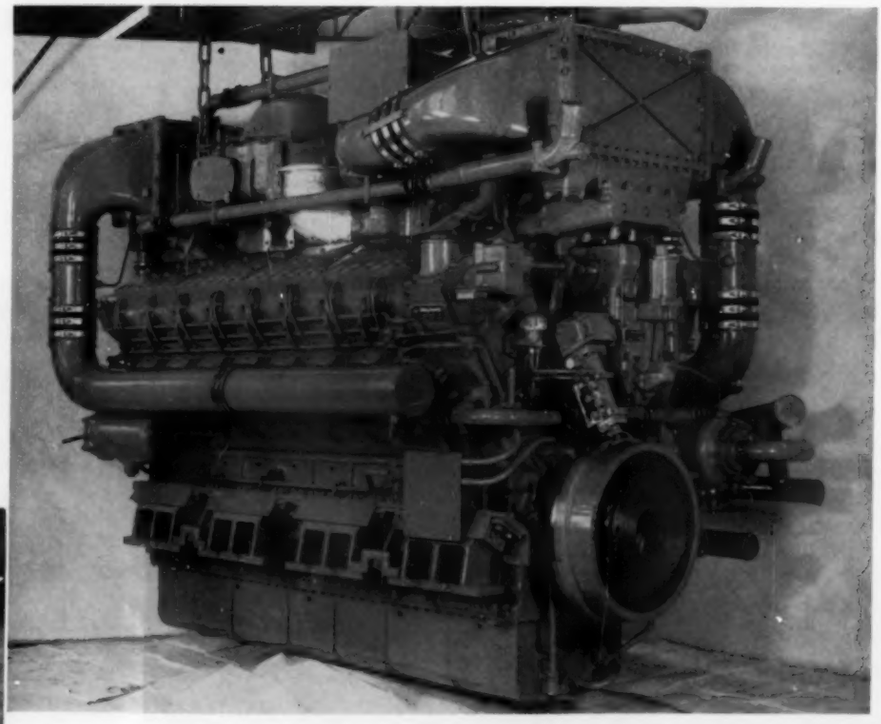
More surprising was the decision to try diesel-hydraulics in the first place. U.S. railroaders have been generally inclined to take the position that the hydraulic drive might be all right in Germany, but wasn't suited to U.S. operating conditions. Why, then, a sudden reversal on the part of two U.S. roads? According to Southern Pacific vice president, W. D. Lemprecht, the high maintenance of electric traction motors in heavy-gradient, low-speed mountain freight service was the chief cause of the decision to try the hydraulics. There was also a potential advantage in having more horsepower available in each individual unit; the Germans said it could be done, and the two U.S. roads, in effect, asked them to prove it, along with claims of lower maintenance and greater adhesion.

The locomotives are from K-M's Munich plant. Prime movers are a pair of MD 870 V-16 high-speed (1500 rpm) four-cycle engines built by Maybach Motorenbau, Friedrichshafen. The engine is fitted with a Maybach-built single-stage vertical-shaft exhaust gas turbocharger and charging air is intercooled. A total of 323 V-16 engines of similar design have been delivered, and have been applied in high-speed naval vessels requiring a short-time rating of 3600 hp at 1900 rpm; the 2000 hp rating, conforming to temperature and atmospheric pressure standards (68° F. at 14.23 psi) established by the International Railway Union, is regarded as a conservative one.

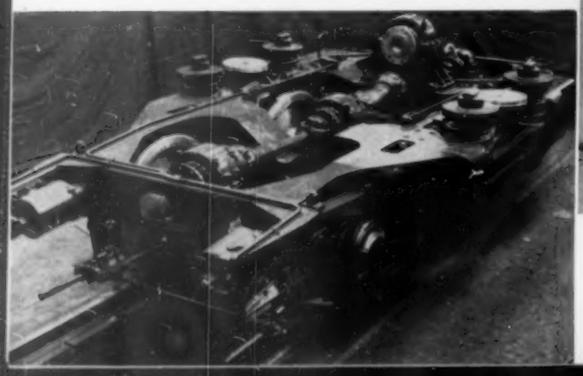
Each engine drives, through a Cardan-shaft, a Voith Turbo transmission type L 830 rU consisting of three torque-converter stages and reversing gear. Each torque converter stage consists of a pump impeller, turbine runner and stationary guide ring, with blading for different torque-speed ranges.

Changeover from one converter stage to another is accomplished automatically in response to the engine fuel controller position and track speed, by means of a small spring-loaded centrifugal governor which controls the filling and emptying of successive converters. The hydraulic changeover provides for an overlapping of filling and emptying so there is no power flow interruption.

Bolted to the transmission casing, and connected to the output shaft, is a Voith KB 510 hydrodynamic brake, consisting of a double-entry rotor and a stator with two matching bladings. Braking force is varied through eight steps by successive degrees of filling.



**Maybach MD 870 diesel is four stroke turbocharged and aftercooled unit.**



**Six wheel bogie showing Cardan shaft drive with centerless construction and distribution gear case.**

**Krauss-Maffei 4000 hp diesel-hydraulic locomotive in Southern Pacific colors at Gloggnitz, start of test run.**

**Southern Pacific vice-president, W. D. Lamprecht, with German engineer in cab of locomotive.**

Transmission from the output side of the transmission is by a Krauss-Maffei transfer case and final drive is through three Maybach bevel-spur axle gear drives. Transmission of power between all drive components is through heavy-duty Cardan shafts. Each engine is equipped with a three-cylinder air compressor for the Westinghouse Air Brake system and the pneumatic control circuits of the locomotive.

While there has been considerable interest in the U.S. in the drive system and engines, the chief question to be answered is how the locomotives will perform under U.S. operating conditions. The Semmering tests, and previous tests carried out on the German Federal Railways, provided only a partial answer.

A major obstacle to testing under U.S. conditions is the lower axle-load permitted in Europe. The locomotives are designed for an axle loading of 27.6 short tons in full working order, while the limit on both Austrian and German railways is considerably less (22.9 in Austria, 22 in Germany).

Weight was reduced to a minimum for the Semmering tests, but even with fuel capacity reduced from 3280 gals. to 660 axle load was 25.4 tons.

The line chosen for the tests—the Semmering—is generally regarded as the closest approach in Europe to U.S. operating conditions. Gradients on the North Ramp match those found on both the SP and Rio Grande—maximum 2.523%, boosted to the equivalent of 2.7% by sharp, uncompensated curves.

Test runs—one trip each way per day—were made with scheduled Austrian Federal freight trains, tonnage averaging about 950 short tons and the number of axles ranging from 70 to 90 depending on the number of loaded and empty cars.

Performance on all runs was up to the expected standard: advance calculations based on a train weight of 965 short tons, engine weight of 152 tons and engine output under site conditions of 2 x 1900 hp (2 x 1770 hp input to transmission, approximately 3000 total hp at the axles) allowed for a speed of 14 mph on the maximum gradient, ranging up to 31 mph on a gradient of 1.0% (average for the first five miles of the North Ramp). Actual performance matched the expected curve almost exactly, with the controller cut back several notches to avoid exceeding speed restrictions on some of the lighter gradients.

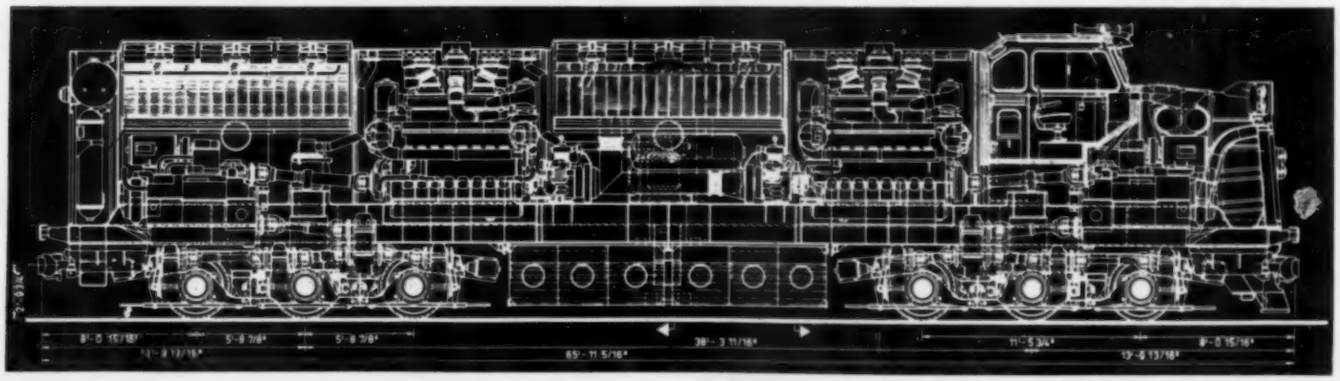
The hydrodynamic braking—a necessity for protracted downgrade operation in the States—was closely watched. With downgrade speed restrictions of 19 to 22 mph depending on the exact location, the train was kept within speed limits consistently with dynamic braking alone, air brakes being used only for full stops and for momentary restrictions at track repair locations.

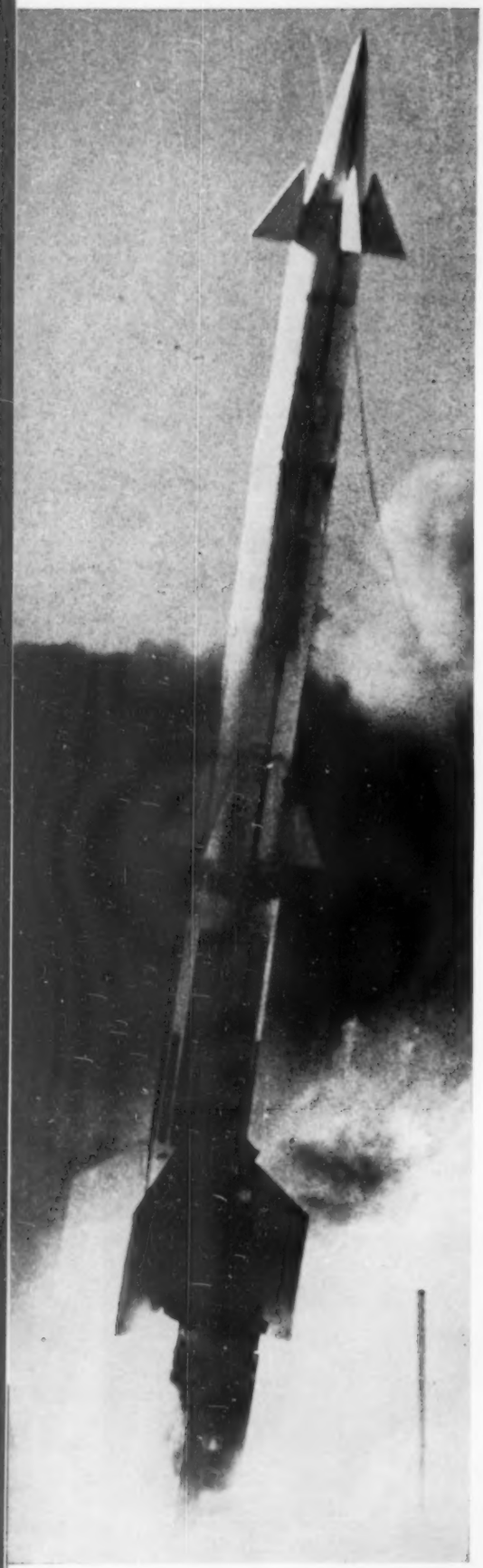
Earlier, during March and April, K-M and U.S. engineers conducted tests with one of the locomotives on a level line of the German Federal, using steam locomotives for controlled braking and traction in order to test both tractive effort and brake effort of the 4000 hp unit. With an engine weight of 152 tons, measured drawbar pull exceeded advance calculations slightly throughout the speed range from 10.5 mph to 70 mph. Horsepower, measured at the drawbar, followed three overlapping parabolic curves corresponding to the three converter stages. Stage 1 showed an increase from 2100 hp at 10 mph to 2900 at 25 mph, dropping to 2700 at 35 mph; horsepower at 70 mph in the third converter stage was 2600.

With train brakes set and engine brakes off, power was applied one step at a time; a maximum starting tractive effort was reached at the 14th control notch (the 15th was not used) of 106,000 lbs. and a maximum adhesion coefficient of 0.345.

Before returning to San Francisco, Southern Pacific's Lamprecht summed up what he'd seen: "During the tests the locomotive has performed just as we expected it to. What we want now is experience." What will happen when U.S. diesel-shop forces face torque converters and Cardan shafts and Maybach engines for the first time may well have as much to do with the locomotives' future as their tonnage ratings. Mr. Lamprecht, for instance, admits that the new locomotives will probably have to prove themselves markedly superior to the diesel-electric in other respects if they are to result in repeat orders.

**Drawing shows location of engine, power train on the locomotives.**





# PRECISE POWER FOR ZEUS RADAR

THE Army's Nike-Zeus is the only anti-missile missile system under advanced development by the United States. Designed to meet the threat of the enemy ICBM, the Zeus develops a massive 450,000 lbs. of thrust at launch and rises at many times the speed of sound to intercept enemy missiles. This critical defense system is being developed by an Army-Industry team.

The Army Ordnance Missile Command at Redstone Arsenal, through the Army Rocket and Guided Missile Agency, is coordinator and technical supervisor of the team in the development of the Nike Zeus. Western Electric Co. is prime contractor. Bell Telephone Laboratories, a subsidiary of The Western Electric Co., is responsible for overall research and development, and Douglas Aircraft, a subcontractor to the Bell Laboratories, builds the missile. Other subcontractors add their special talents to the program.

The Nike-Zeus anti-missile missile has three solid propellant stages. The booster's nearly half-million lbs. of thrust makes it the most powerful solid propellant motor ever flown in the U. S. Firing tests for the missile, which will carry a nuclear warhead have been in progress at White Sands Missile Range, N. M., since August 1959. Phases of the test program are also being carried out simultaneously at four sites: White Sands, N. M.; Point Mugu Calif.; Kwajalein Island in the Pacific; and Ascension Island in the Atlantic. Complete Zeus installations are being made at White Sands and Kwajalein. Nike-Zeus missiles will be fired and controlled from Kwajalein to intercept target ICBM vehicles fired from Vandenberg AFB, Calif.

At Ascension Island, target track radar follows actual ICBM's fired from Cape Canaveral, Fla., over the Atlantic Missile Range. Data compiled at Ascension will be used to provide synthetic computer intercept targets for Zeus firing tests at White Sands and Point Mugu.

Diesel-electric plants are a key factor in the capability and reliability of the Nike-Zeus installations since these units must supply precise power for the complete radar system at the remote installations. Precise power in this case means that the units had to meet very exacting system and unit performance. To examine the diesel's role in this important defense system, let's "visit" Kwajalein Island, a 602 acre atoll which was the scene of one of the most bitter battles of World War II.

**Nike-Zeus is only anti-missile system currently under development by U.S. The Army Ordnance Missile Command through the Army Rocket and Guided Missile Agency has coordinated and supervised its development.**

The island today is the scene of much activity as the Corps of Engineers rushes the construction of this complex Nike-Zeus facility. Among major works under construction is the acquisition radar power plant, a structure two stories high and 113 x 180 ft. This building will house nine 1,500 kw diesel-generator units.

The Nike-Zeus is a command guidance missile, meaning the system is put through detection, launch, tracking and firing via ground control. These steps are accomplished through a complex radar system which includes acquisition, discrimination and target tracking units. The acquisition radar scans space at the rate of millions of cubic miles per second. When a signal strikes an object, it bounces back to a receiver, which feeds the signal to a computer to determine the track of the incoming object. The target also then comes to the attention of the discrimination radar which provides the information needed to sort out the real warhead from decoys which might be accompanying it to confuse the defenders. When the true target is identified, the target tracking radar comes into the picture. This system follows the target, and feeds data to a computer which determines when a Nike-Zeus should be launched, controls flight of the anti-missile missile and at the right instant, detonates it to destroy the enemy missile in flight.

The diesel-generator sets at White Sands, and those at Kwajalein for the acquisition phase, were supplied by The Cooper-Bessemer Corp., under a $6,000,000 contract with the Army Corps of Engineers, which is in charge of the construction. Four of the 13 sets covered in the contract are installed at White Sands, the other nine are being installed at Kwajalein.

These highly specialized 1,500 kw units were supplied complete with associated mechanical, electrical and control equipment. The engines are Cooper-Bessemer's model LSV-12-T which develop 2,120 hp at 327 rpm and are directly connected to Electric Machinery Co. 1,500 kw generators rated 2,400/4,160 v, 3-phase, 60 cycles, 0.8 P.F., at the 327 rpm engine speed. A static type exciter, also by Electric Machinery, is utilized. The LSV-12-T is a turbocharged, 12 cylinder engine with bore and stroke of 15½ x 22 in. It is equipped with Woodward model LSG-10 load sensing governors for precise speed control. Vapor

**Buildings in the Nike-Zeus acquisition radar area on Kwajalein Island in construction view. Powerhouse for this part of system is building at left center. Large circular structure in right foreground is acquisition radar transmitter; domed structure is receiver antenna building.**

Phase ebullient cooling on the engines is by Engineering Controls Inc.

The LSV-12-T units are automatically started and controlled by Cooper-Bessemer En-Tronic controls. Starting is done remotely by throwing a switch on the control panel. The engines are equipped with air starting valves in the cylinders and use a 250 psig starting air system. A standard gauge and alarm panel is used in this application. The signalling equipment on these En-Tronic local control panels is connected to a central control panel on the mezzanine floor above the engines. The operator can trip the main generator circuit breaker switch from the local panel under emergency conditions. Conversely, the operator on the main panel on the mezzanine floor can also operate the engines and shut them down. Each panel is connected by phone with the main panel. An audible alarm and flashing light indicates from which engine the emergency call is coming.

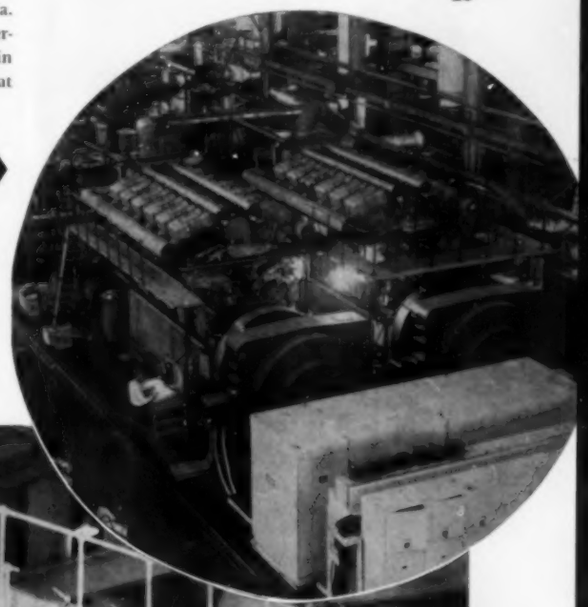
In order for the Nike-Zeus to accomplish its mission to seek out, identify and destroy enemy missiles in flight, the voltage and frequency variations of the generating systems supplying power to the control units must be kept to an absolute minimum. To assure that the diesel-generator sets would meet their mission, they were put through three separate critical tests. Prior to being built, the complete electrical system was simulated on an analog computer to assure that all components which could affect the quality of the electrical energy were completely compatible with the precise power specifications issued by the government. The computer program was complicated by the fact that several units had to be analyzed.

The other two tests were carried out to prove conclusively that operation of the diesel-electric sets built were in accordance with design criteria. One of the tests was performed in the Cooper-Bessemer factory at Grove City, Pa., the other in the field. The factory test was unique in that the engines and generators and associated control equipment were assembled at the builder's plant and exhaustively tested. The field test was a complete additional check to assure that the "as installed" equipment and systems were in complete accord with the specifications.

Principal Equipment Serving
Cooper-Bessemer's LSV-12-T Units

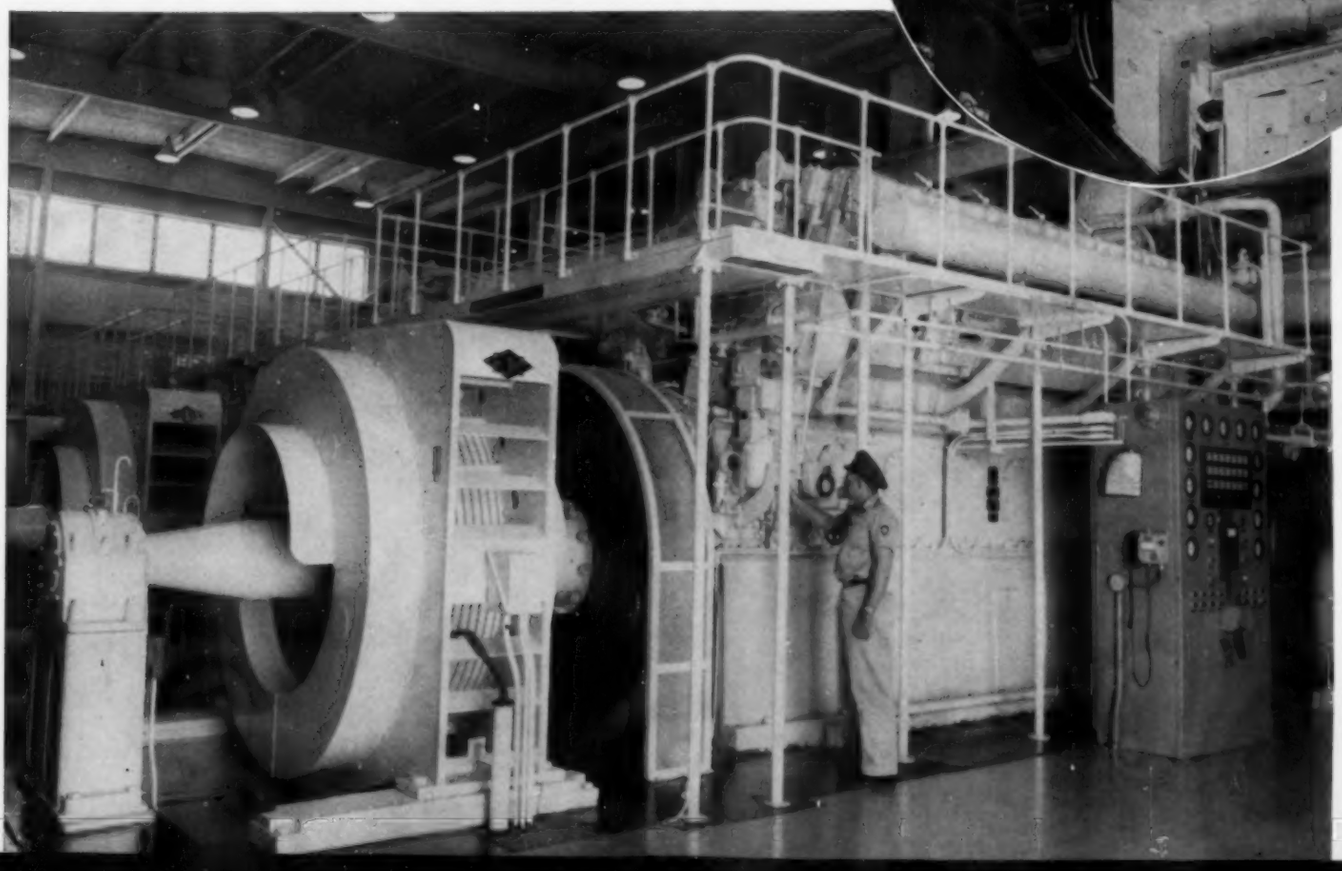
| | |
|---|---|
| Generators, exciter | Electric Machinery |
| Governors | Woodward |
| Fuel oil filters | CFC Commercial |
| Lube oil filters | Peco |
| Thermostatic controls | Amot |
| Before-and-after lube pump | DeLaval Imo |
| Air intake filters | American |
| Exhaust mufflers | Burgess-Manning |
| Exhaust pyrometer | Alnor |
| Vapor Phase cooling | Engineering Controls |
| Switchboard, instruments | ITE |
| Jacket water pump | Allis-Chalmers |
| Lube oil coolers | Basco |
| Fuel oil transfer pump | Roper |





**Two of the Cooper-Bessemer diesel-electric sets for the Zeus system at Grove City, Pa., plant during factory testing phase.**

**Four Cooper-Bessemer diesel-electric sets are installed at White Sands, N. M., nine are at Kwajalein. These model LSV-12-T engines rated 2120 hp at 327 rpm, drive Electric Machinery 1500 kw generators to power the acquisition radar system. Installation also features Vapor Phase high temperature cooling by Engineering Controls, Inc.**



the *Natchez* a total of 800 hp. This power is transmitted to General Electric traction motors located in the turrets in the aft section of the hull. This diesel-electric combination is the same type of equipment which the Missouri Pacific uses in some of its locomotives and use of the turret drive makes 100 per cent of the horsepower available for steering from the standing position. The stern steering and propulsion units are in individual sections attached by means of hinges and through bolts to the hull. Thus each turret may be raised individually to change a propeller, propeller shaft, or bearing without necessity for going into dry dock. The propellers are Coolidge 60x42 in. four blade, steel, and flanged Goodrich cutlass bearings are used.

**Stern steering and propulsion units on the *Natchez* house the turret and include the traction motors which power the propellers. Here the starboard turret is raised to demonstrate how each unit is hinged to vessel, allowing the crew to clear or change wheels without going into drydock.**

***Natchez* handles 265x44x11 ft. barge, is a vital link in rail traffic. Barge handles nine freight cars, frequently ferries Army tanks bound for maneuvers.**

# RAIL FERRY HAS TURRET STEERING

*By* W. L. BODE

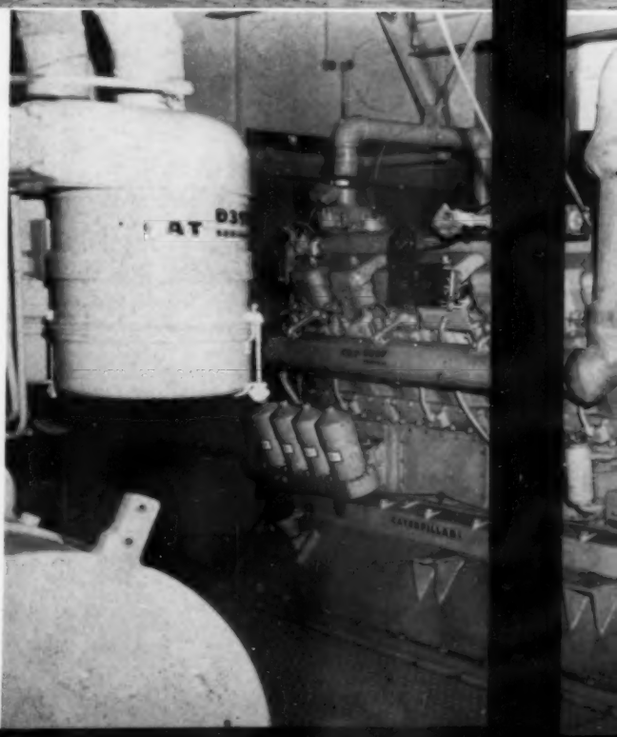
OPERATING across the Mississippi between Vidalia, La., and Natchez, Miss., is a unique railroad car ferry whose propulsion power is supplied by a pair of diesel-electric sets which power electric traction motors. This combination, plus utilization of turret steering, eliminates the conventional rudders usually employed on this type of river vessel.

The *Natchez*, built by the Missouri Valley Steel Co., for the Missouri Pacific Railroad, is in service operating the railroad car ferry for the Missouri Pacific, Natchez and Southern Railway and the Mississippi Central Railroad. The ferry is a vital link in rail transportation since there is no connection between Vidalia and Natchez except over the ferry. If it is unable to operate it would be necessary to reroute rail cars as far north as Memphis and south to Baton Rouge.

The new 80 x 28 x 9 ft. *Natchez* replaces a 165 ft. stern wheeler which had been in operation since 1886. The 1½ mi. round trip across the Mississippi between Vidalia and Natchez is made in an average running time of 24 minutes. The *Natchez* handles a 265 x 44 x 11 ft. barge with a double track turnout on the barge. One track holds four railroad cars, the other five. The ferry goes into operation about 5:30 a.m., and runs till all cars are transferred across the Mississippi, handling an average of 75 cars a night. She carries a pilot and engineer and two deck hands.

The *Natchez* uses the same principle of turret steering as was utilized in the experimental towboat *Missouri Valley*, to test this type of propulsion and steering.

Power for the *Natchez* is provided by two Caterpillar D397 diesel engines equipped with Roots blowers. These engines each drive a General Electric 450 volt dc generator rated 300 kw, giving

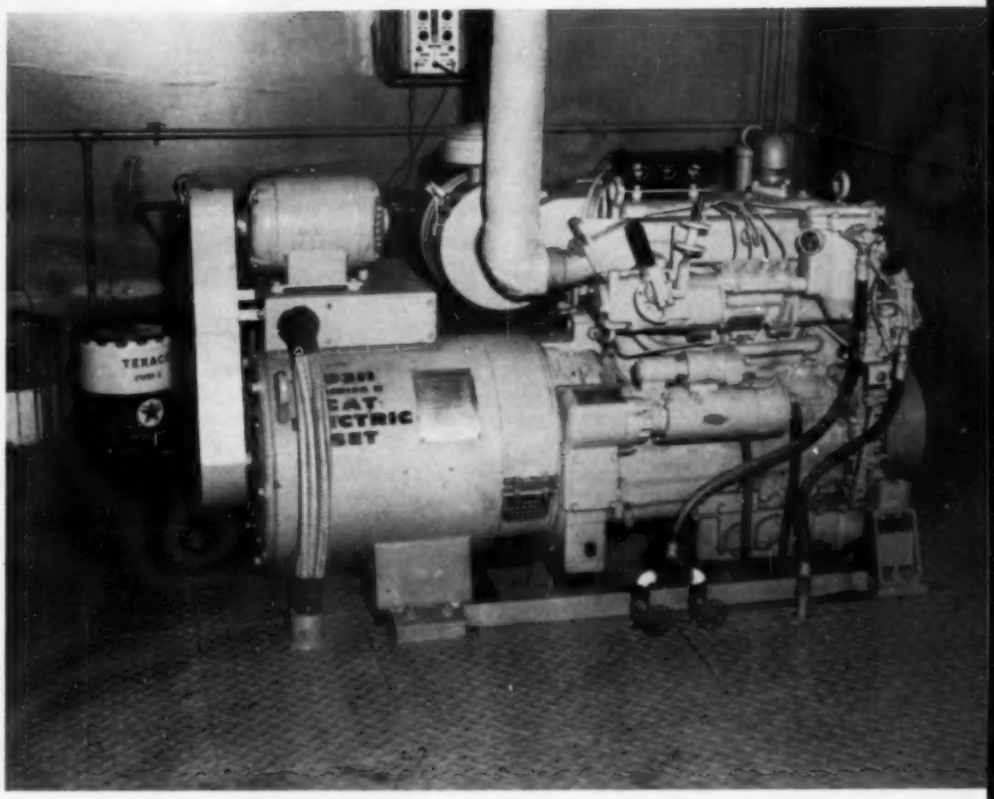


**Cat D397, Roots blown diesels drive GE 300 kw generators to provide power to the traction motors which propel the *Natchez*. The two 12 cylinder diesels give the vessel a total of 800 hp; turret drive makes 100 per cent of horsepower available for steering from standing position.**

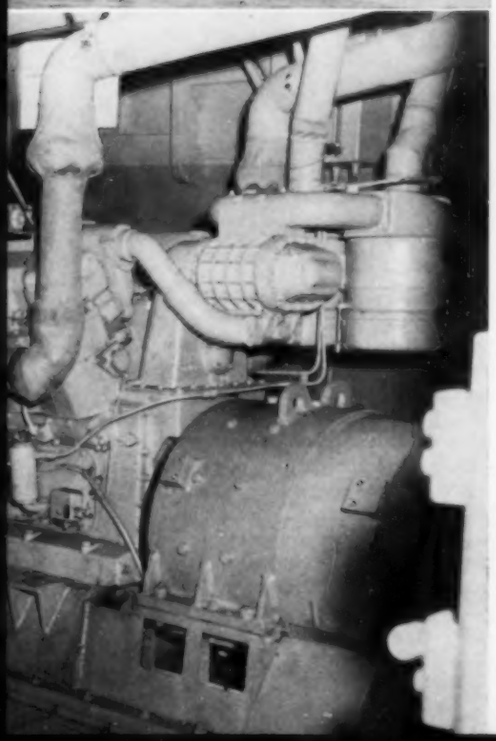
Steering for each of the turrets was furnished by Sperry Piedmont and is of the electric servo system with repeatback. The latter feature holds the lever steerers so they are always in the same position as the line of thrust of each propeller and its turret. The steering and control console in the pilothouse has two lever steerers and two Westinghouse Air Brake throttle controls along with electric tachometers to indicate wheel speed.

The Westinghouse throttles are similar to those used on conventional boats with clutches and reverse gears except that, in this instance, as the throttle is advanced in the forward position, the field is selected for forward rotation. Then, as the throttle is increased, excitation of the generator is increased until the full horsepower of the diesel engines operating at high idle is absorbed. As the throttle is further advanced, the engine rpm is brought up to develop full horsepower.

Auxiliary power for the *Natchez* is provided by two Caterpillar D311H diesels driving 30 kw, 120/208 volt ac generators. Either of these units is large enough to provide all necessary auxiliary power for the vessel, including excitation of the main generator fields through silicon rectifiers



**This is one of two D311H electric sets which supply auxiliary electric power on the vessel. Either unit is able to meet all of auxiliary power needs. Excitation of main propulsion power generators is supplied from these 30 kw sets.**



installed in the switchboard. Additional engine room equipment includes a Viking fire and salvage pump, an oil fired hot water heater and a 10 cu. ft. Quincy air compressor. The engine room is protected by a $CO_2$ fire extinguishing system. All the engines are keel cooled.

Because the pilot must see over the railroad cars on the barge in front of the *Natchez*, the pilothouse has been located with a 27½ ft. line of sight with the vessel fully loaded. The hull of the boat is of ⅜ in. steel on the sides and bottom with $\frac{5}{16}$ in. deck.

**Pilothouse of the *Natchez* is elevated 27 ft. above waterline to provide necessary line of sight over rail cars on the ferry barge. The 80x28x9 ft. boat was built by Missouri Valley Steel Co.**

# LABORATORY SAMPLING PROGRAM AIDS INDUSTRIAL ENGINE COOLANT CONTROL

## Research in Problems Arising from Demand for Continuous Operation, Maximum Efficiency of Industrial Engines Led to Two New Cooling System Products from Dow Chemical Co.

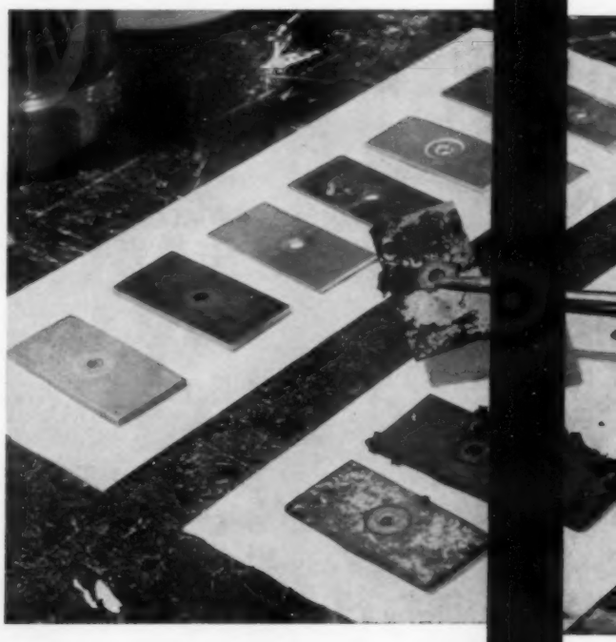
OVER the years, design advances and mechanical improvements have contributed to more efficient, more economical industrial engines. Advancing technology has solved many problems, but some still remain almost untouched in the face of engineering progress. Take engine cooling problems for example. The increasing demands of continuous operation and the drive for maximum efficiency have put new loads on cooling systems still plagued by the old problems of rust, corrosion and scale buildup which hinder good heat transfer. In fact, importance of the cooling system as an integral part of the engine design should be a key factor as related to operating considerations. Emphasis on the cooling system is provided through a program developed by The Dow Chemical Co. Dow has built a maintenance program around two new coolants, Ambitrol FL and Ambitrol CN.

Ambitrol CN is a freeze-depressant concentrate based on ethylene glycol and contains a blended inhibitor system developed to meet the design requirements and practical needs of stationary industrial engine cooling systems operating with many varieties of local waters. Ambitrol FL is a completely formulated fluid consisting of glycols, deionized water, and inhibitor which completely fills the cooling system. It is designed to provide freeze protection for industrial cooling systems down to -40° F, with protection against overheating up to 240° engine temperature. Since it is a completely formulated coolant, the problem of dilution with local waters which might produce corrosive action is eliminated.

Backing up these industrial engine coolants, Dow offers a cooling system maintenance program designed to maintain the Ambitrol products at maximum efficiency for a maximum useful life. This maintenance program is designed to complement normal engine maintenance programs and works like this: Coolant samples taken 24 hrs. after initial filling with Ambitrol are sent to Dow laboratories in Midland, Mich., where they are analyzed. The analysis is reported to the engine operator and logged by Dow. A second sampling is taken after six months, and compared with the initial sample. This analysis shows the degree of inhibitor depletion and is the basis for replenishment to maintain maximum efficiency for extending the useful life of the coolant. Follow-up samplings taken periodically twice yearly unless otherwise indicated provide a continuing safeguard on coolant protection.

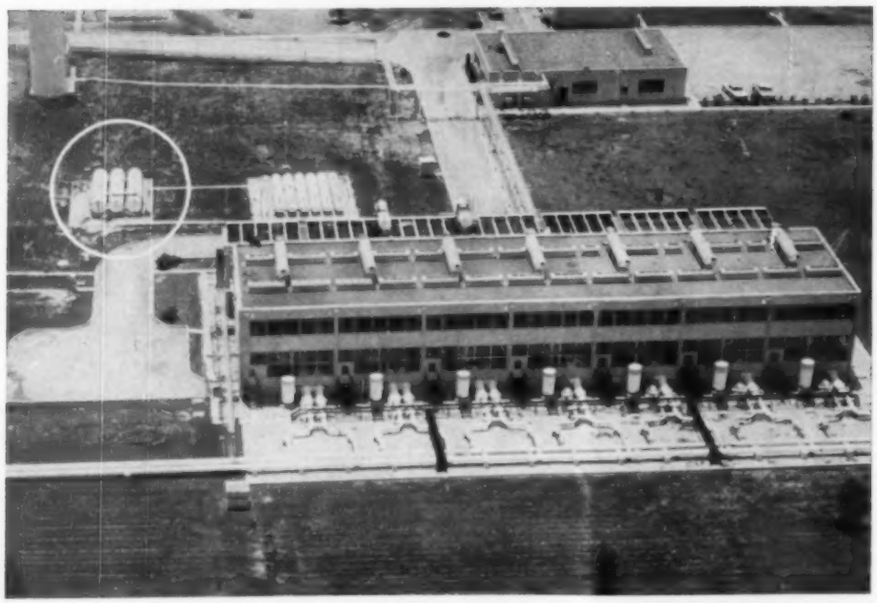
Although under development in eight years of laboratory and field research, the Ambitrol line of products and its maintenance program has been generally available less than a year and field operating data has not been compiled in much depth. Still there are some general conclusions reached as the result of operating experience which runs the gamut of weather conditions. From the Texas panhandle to Louisiana, from Montana and Wyoming to metropolitan New York, use data is being collected from pumping station installations. Already, Dow says, there are indications that "the products and the program are contributing to a significant degree in improving engine performance."

Just as the physical locations vary, so do the types of engines in which the products have found application. Clark, Ingersoll-Rand, and Cooper-Bessemer are some of the engines cooled with Ambitrol FL or Ambitrol CN and currently are operating at nearly 24 locations. The horsepower ratings range from 3,500 hp Cooper-Bessemer LSV-16's to 185 hp Ingersoll-Rand's. Coolant quantities range from 180 gals. to nearly 6,000 gals. in one multiple-engine installation.



Field use data collected from these installations indicates that the qualities of the coolant and the emphasis on good cooling system maintenance procedures contributes to more uniform engine temperatures by minimizing hot spots, steam pockets, foaming and air entrainment. By permitting engines to operate throughout closer to design

Hampshire, Tenn. gas engine-compressor station on Columbia Gulf Transmission Company's main line. Dow coolant is stored for make-up in one of three circled above ground tanks.



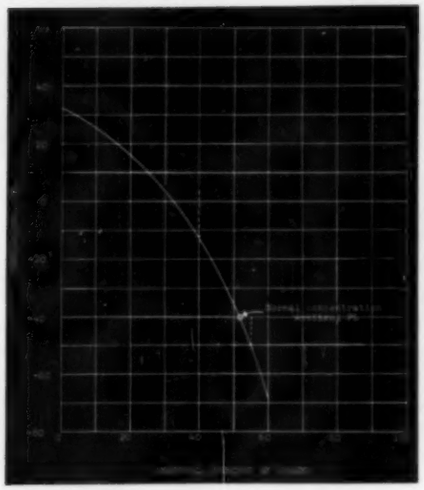
In coolant lab, many additives for corrosion inhibitors are screened by glassware corrosion tests which allow measuring effect on samples of metals commonly used in cooling systems. Here air is bubbled through test inhibitors to speed any corrosion.

Metal coupons in back row were tested in Ambitrol fluid, those in front row in water or conventional fluids. Materials are, from left, aluminum, cast iron, steel, brass, solder, and copper.

temperature, engine parts such as valves, pistons, rings, and sleeves are given the best environment for long, troublefree life.

In addition to maintaining control over the chemistry of the coolant, the sampling program has uncovered many cooling system problems which are often overlooked but which contribute to inferior engine performance. Incomplete cleaning of cooling systems is one of the most frequent problems pointed up by the sampling procedures. Dow recommends the Ambitrol FL for new engines particularly, because it eliminates the need to add local waters which often are highly corrosive. Dow laboratory and field research indicates that Ambitrol FL properly installed in a new engine could have a useful life of four to five years if suggested maintenance procedures are observed. However, cooling systems even in new engines should be thoroughly flushed to remove particles or scale which can clog coolant passages.

When it is not desirable to use the full-fill system, the Ambitrol CN offers protection through a concentrate with an inhibitor level regulated to meet the needs of the system. In one typical case,

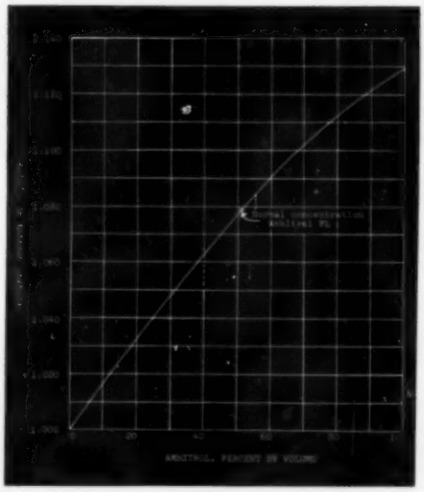


Freezing points of aqueous solutions of Ambitrol CN and FL.

a sample taken from an engine after several months in operation with Ambitrol CN showed depletion of inhibitor. The inhibitor was replenished and a sample taken after another interval of operation showed inhibitor balance had been restored and corrosive action avoided.

Sometimes, the analysis can pinpoint a problem outside the cooling system which could go unnoticed until it showed itself in terms of excessive engine damage. Take the case of an installation in a sandy area. Here, the coolant sample was heavily loaded with sand. The sand was filtered out of the sample at the Dow laboratories, dried and sent to the operator to show him what was getting inside the engine. Frequently, traces of oil show up in the coolant sample indicating leakage symptomatic of sometimes serious trouble. In such cases, corrective action may be suggested by Dow's coolant technologists if the difficulty is localized with the cooling system. More frequently though, the corrective action is obvious to the operator when he is made aware of the potential problem.

Specific gravities of aqueous solutions of Ambitrol CN and FL.



Lever in driver's compartment enabled operator to switch from diesel fuel to combat gasoline and back again at will during the demonstration. Lever would not be needed for regular operation as the engine utilizes either fuel or any mixture of such fuels without adjustment.

# DETROIT DIESEL'S LINE OF MULTIFUEL DIESEL ENGINES

*By* J. W. BROWN

FOR many years the military has been seeking power plants that could burn a wide range of fuel. Development of such an engine could go a long way in solving the problem of fuel logistics during wartime when an abundance of, say, gasoline or jet fuel might be on hand in a particular theatre but diesel fuel might be in short supply. At a demonstration recently at the General Motors Research Center, GM's Detroit Diesel Engine Division showed off their new engine developments that could go a long way in solving this need. Shown at the gathering was a family of compression ignition multifuel engines that can be operated on fuels ranging from No. 2 diesel fuel to combat gasoline.

Detroit Diesel's new development will make available for the armed forces in January 1962 12 multifuel units ranging from 20 to 650 hp which go far in solving the military's logistical problems in supplying fuel for all types of military equipment under all conditions.

The new multifuel engines are adaptations of Detroit Diesel's standard "V" and "inline" models in the commercial series 53 and series 71 lines. All have the same basic 2-cycle design, regradless of power output. In addition, the whole series of 12 multifuel engines from 20 to 650 hp comprises only two cylinder sizes, and this provides good interchangeability of parts. These features would seem to be important to the military because they simplify maintenance and repair procedures and reduce the number of back-up parts required to safeguard field operations. The parts needed for the conversion of existing engines will be made available and military equipment now in use or under development can be changed over easily and at a relatively low cost.

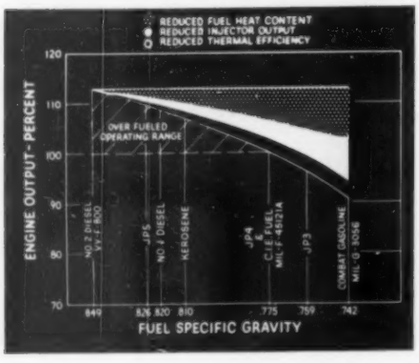
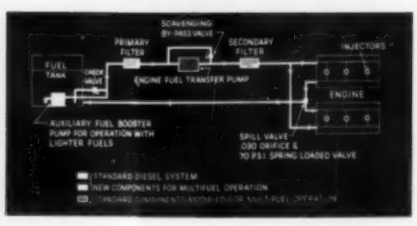



Chart at left shows effect of fuel gravity on max. engine output with 100% output on C.I.E. fuel in GM 6V-53 multifuel engine at 2800 rpm. Chart below shows layout of Detroit Diesel multifuel engine fuel system.




Introduction of the new multifuel engines in Detroit was made by Clyde W. Truxell, general manager; Robert E. Hunter, general sales manager; C. W. Frederick, director of engineering and Kenneth L. Hulsing, assistant director of engineering of the division. After the engineering aspects of the development had been described by Hulsing, a prototype 8-wheel, 8-wheel drive personnel carrier developed for the army by GMC Truck and powered by a 6V-53 multifuel engine was demonstrated. The truck, for these purposes, was fitted out with dual tanks which enabled the driver to switch back and forth from diesel fuel to army combat gasoline at will. Acceleration, speed and idling were so similar on the different fuels as to defy detection as to which fuel was being used at any given time.

As pointed out by Hulsing, there has as yet been no hard-and-fast military specification written to define what is meant by "multifuel" engine. The military, particularly the army, has indicated the desire for engines which will operate well on No. 2 diesel fuel (MIL-VV-F800), army compression-ignition engine fuel (MIL-F-35121A), and combat gasoline (MIL-G-3056), as well as any and all mixtures of these, and on intermediate fuels like kerosene, No. 1 diesel fuel and the JP series of jet fuels. All of these fuels to be burned without engine modification or adjustment.

Mr. Hulsing outlined the difficulties presented by the natural characteristics of the lighter fuels when attempts are made to burn them in a standard diesel engine. Among these varying characteristics are the differences in viscosity, vaporization, compressibility, compression-ignition temperatures and Btu content.

Taking these in the order named: The low viscosity of a light fuel directly affects the efficiency of injectors designed for heavier fuels; the tendency of gasoline to vaporize at relatively low temperatures presents vapor-lock problems not commonly encountered in diesel operation; the higher compressibility of the lighter fuels presents metering problems when put through standard diesel injection equipment; gasoline with high octane content actually resists compression ignition, and the lower the specific gravity of the fuel burned the less heat content, or less power obtainable from it in the engine.

In its program the Detroit Diesel Engine Division sought ways to meet the need for a multifuel

engine and still keep the basic design of their over-all engine line intact. This would mean that production could be established with minimum tooling, and on existing assembly lines. It also meant that parts for the new multifuel engines would be completely adaptable to the existing Series 53 and Series 71 engines, making conversions of existing engines a relatively simple matter. It also meant that *any* Series 53 or Series 71 engine could be built as, or converted to multifuel. This made it possible for Detroit Diesel to offer a very broad power range of multifuel engines.

The three basic parts which it was found necessary to change, as compared to normal Detroit Diesel engine parts, were the pistons, the injectors and the fuel pump.

To overcome the resistance of the octane content of gasoline to compression ignition, higher compression ratios were found to be advisable. As a result Detroit Diesel changed the design of their pistons by slightly modifying the bowl in the top of the piston so as to yield a 23:1 compression ratio as opposed to the engine's normal 17.5:1 compression.

It was further brought out that the "fire ring" contributed importantly to the success of the new multifuel piston design. Located near the top of the piston the fire ring aids closer control of compression, expecially at cranking and idling speeds and reduces heat losses by reducing the surface-to-volume ratio of the combustion chamber. The combination of fire ring pistons and increased compression ratio is said to give adequate pressure and cylinder temperature for unaided starting on combat gasoline down to about 40° F. Integral air box heaters are available to aid starting down to -25° F and winterization kits provide a starting aid down to -65° F.

Coincident with the development of the multifuel engines, Detroit Diesel was developing a new needle-valve injector. Slight modifications from the intended production type needle-valve injector resulted in an injector which is well suited to multifuel operation. For one thing, the needle-valve injector retains less fuel in the tip after injection, and this eliminates a vaporization problem encountered when gasoline was put through the standard (diesel type) unit injectors.

The new needle-valve injectors are still "unit" injectors—one to a cylinder, with no centralized high-pressure fuel pump. Modification for multifuel use will be principally along the lines of increasing the capacity to make up for the lesser heat content of lighter fuels.

To overcome the problems of vapor lock in the fuel system when using high specific gravity fuels (particularly gasoline), it became necessary to speed up the flow of fuel through the fuel lines, the injector bodies and the fuel return lines. To accomplish this, part of the multifuel "kit" will be an engine fuel transfer pump with approximately twice the normal capacity. Also, between the fuel tank and the engine fuel transfer pump, fuel flow will be further accelerated by means of an electrically (battery) driven "booster" pump, in or near the fuel tank. This primary fuel pump has an additional advantage in that it is able to "purge" the fuel system of air or vapor at any time, independently of operating the engine. To facilitate this, a "bypass" around the engine fuel pump is installed. To maintain fuel system pressures at low speed or while idling, a pressure-regulating fitting composed of a small orifice in parallel with a spring-loaded spill port or bypass is added.

To provide optimum operation on the wide range of fuels between No. 2 diesel fuel and combat gasoline, Detroit Diesel finds that engines fitted out for best operation on the intermediate grade—the army's C.I.E. or compression-ignition engine fuel—give the best overall result.

When "fueled" for C.I.E. fuel, and with C.I.E. operation shown as 100%, the engine's output on army combat grade gasoline is in the order of 95%. It is estimated that a standard spark-ignition gasoline engine in the same vehicle would produce about 60% as much work on the same amount of gasoline.

Robert E. Hunter (left), general sales manager; Kenneth L. Hulsing (center), ass't. director of engineering and Clyde W. Truxell, general manager of Detroit Diesel demonstrate the wide fuel flexibility of the multifuel engine in an army truck, by putting gasoline and diesel fuel in the same tank at the same time.

Army "8x8" prototype medium duty truck, manufactured by GMC Truck and Coach Division of General Motors, used to demonstrate new multifuel 6V-53 engine.

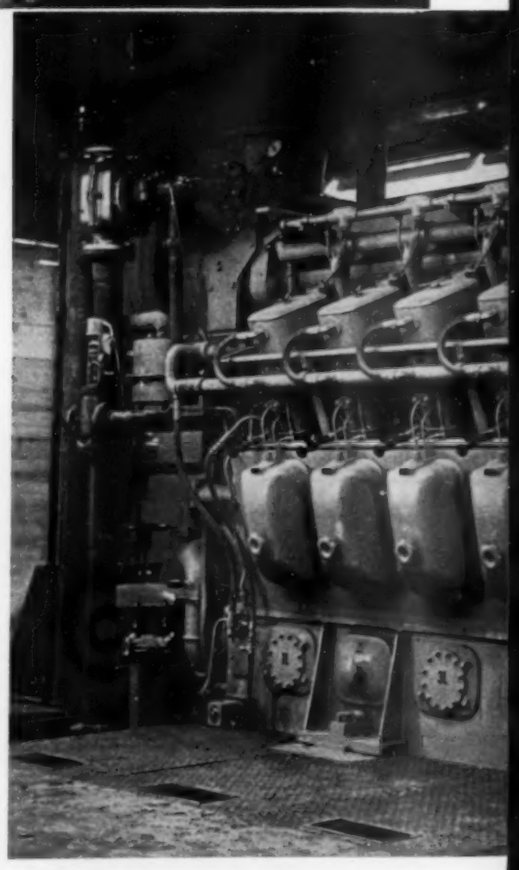
# DUAL FUEL ENGINES SERVE PIPE LINE

## Alco Engines in Stations on Trunk Line of Service Pipeline Co.; Step-Type Cooling Used at Herndon, Kansas Station with Remote Starting

THE 190,000-mile network of crude oil and products pipelines is one of America's most important transportation systems. Invisible except for occasional pumping stations and other above-ground installations, this system is on the job 24 hours a day delivering crude oil from wells to refineries and petroleum products from refineries to market. At the heart of this network, providing the power necessary to keep the liquids circulating, are the engines and motors that run the pumps.

Alco engines are among those prime movers so essential to economical, dependable pipelining. One example, as pictured on these pages, is the use of Alco model 251 engines at two key stations on the Wyoming-Missouri trunk line of Service Pipe Line Co., an operating subsidiary of Standard Oil Division of American Oil Co.

Service has been operating crude oil pipelines since 1916, when it began life with 487 mi. of gathering and trunk lines in Oklahoma and Kansas. Today its system includes 15,000 mi. of pipe in 15 states, reaching oil fields in such far-flung areas as northwest Wyoming, North Dakota, New Mexico, the Texas Gulf Coast, and Arkansas, and connecting them with refineries in large industrial areas like Chicago, St. Louis, Kansas City, and Houston. At many points on the system are interconnections with other pipelines, through which the crude can be transported to refineries in other parts of the country. Like other pipeline companies operating interstate, Service is a common carrier—committed to provide transportation service to any shipper of oil requesting it, to the extent of facilities, and operating under the rules of state and federal regulatory agencies.



Laton, Kans., pump station of Service Pipe Line Co. On building are exhaust stacks, left, and cooling towers. Pumps are under porch roof.

Service's big-inch line from Ft. Laramie, Wyo., to Freeman, Mo., was built in 1954 to provide a more adequate outlet for crude from Wyoming and the Denver-Julesburg Basin. The company, except for a few years, had been transporting oil from Wyoming wells through a smaller line since 1923, but the new line offered two distinct advantages: greater capacity and greater efficiency. The big-inch line (using 20, 22 and 24 in. diameter pipe) originally had three main pumping stations, one of which (at Laton, Kans.) was engine-driven. The capacity of the line was increased still further in 1959, and of the three intermediate stations added that year, one (Herndon, Kans.) also used dual-fuel engines.

It was at Laton that Service first installed Alco equipment to drive the Bingham 10x14x16 in. single stage centrifugal pumps on the Wyoming line. The original installation consisted of two model 251 dual-fuel, 4 cycle, 16 cylinder vee type engines, turbocharged and rated 2083 hp at 1000 rpm. These 9x10½ in. bore and stroke engines drive Falk 3.964:1 ratio speed increasing gears.

Alco installation at Herndon, Kans., pump station. Shown is one of two Alco model 251 turbocharged, 16 cylinder dual fuel diesels rated 2083 hp at 1000 rpm.

The pumps are rated 7400 bbls/hr. at 500 psi and 3950 rpm. The engines and their auxiliary equipment were installed in a structural steel building with metal siding. The horizontal, single-stage centrifugal pumps were mounted outside the building under a canopy, with the building wall serving as a firewall between engines and pumps. Laton station was purposely "overdesigned." Although it is an attended station, its control equipment is in a separate building and many design features simulate remote control operation.

Service found that several features of the Alco engine made it especially adaptable to operation by remote control. One of these was air-motor starting. Another was the automatically controlled shift from the use of one type of fuel to another—diesel oil to natural gas or visa versa. Engine-driven pumps for fuel, lube oil and water were also an advantage—and the engines respond readily to orders for speed changes in the 700 to 1000 rpm range. Experience gained at Laton was used in the designing of another, more recent unattended engine-driven station.

By 1959, traffic along the Wyoming line had increased, and the forecasts were favorable for still more traffic in the future. This situation called for additional power along the line. A third Alco 251 unit was put in at Laton station—but an even more interesting addition was the new station near Herndon, in northwest Kansas. Here, for the first time, Service was able to draw on its experience with remote control of engines, add some special design features, and come up with a unique installation.

Herndon's role on the Wyoming line is to relay pumpings from Sterling, Colo., on to Laton. Operators at Ft. Laramie, Wyo., control the starting and stopping of Herndon's two Alco engines—similar to those in use at Laton station. Since the flow rates and pressures along this section of the line vary widely because of the characteristics of the different types of crude, the ability to vary the engine speed at Herndon by remote control is especially important. Herndon's engine room has no windows, and employs a system of forced ventilation in which the ventilating fans maintain a slight positive pressure. They operate only when the engines are running. The engine cooling system is located on the roof of the station building. These units use a step type cooling system with their remote starting, whereby the unit fills with cooling water to a certain level in the engine room piping until a predetermined temperature is reached. This avoids use of anti-freeze in cold weather. As the predetermined temperature is reached, the balance of the system fills. The variable speed fan motor starts at a higher preset point until under full load; the radiator fan is at high speed. The engines will maintain constant horsepower with a sudden loss of fuel gas pressure and will return to gas operation automatically when pressure is restored.

Controls are so designed that engine starts can be accomplished by the use of a single push-button, which initiates the full sequence of events placing the unit "on the line" at idle speed.

Operating experience with the Alco 251 engines has been good at both Laton and Herndon. In the more than five years that two of the Laton units have been operating, there has been only one shutdown of more than 24 hours' duration. Herndon units have also compiled a good record in their year of operation, particularly during the periods of automatic control when virtually no trouble has been encountered. Both maintenance and operating costs have been kept at relatively low levels, and this has been perhaps the most important contribution made by the two engine-driven stations. It is especially important since crude oil pipelines are extremely competitive, and only by finding more economical and efficient methods of operation can any pipeline long remain in business.

### Principal Equipment Serving Alco Engines

| | |
|---|---|
| Air starters | Ingersoll-Rand |
| Governors | Woodward |
| Speed increasing gears | Falk |
| Pump | Bingham |
| Fuel and lube oils | Standard |
| Lube oil filter, strainer | Nugent |
| Cooler | Young |
| Thermostatic controls | Amot & Fulton-Sylphon |

Mechanic adjusts Fulton-Sylphon water temperature control valve on one of the engines at Herndon. Engines use step type cooling which is described in text.

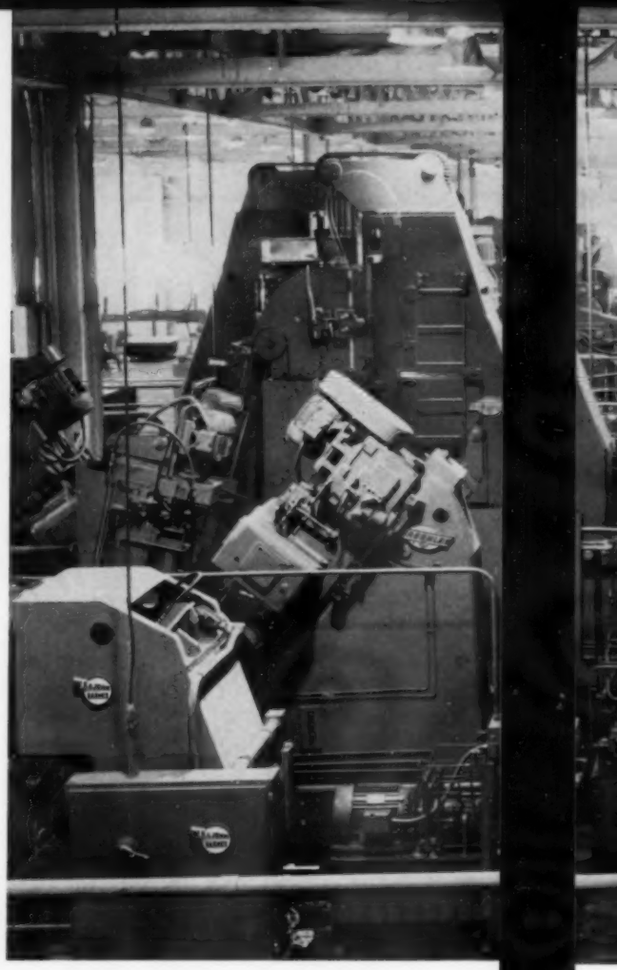
# ALLIS-CHALMERS' NEW ENGINE PLANT

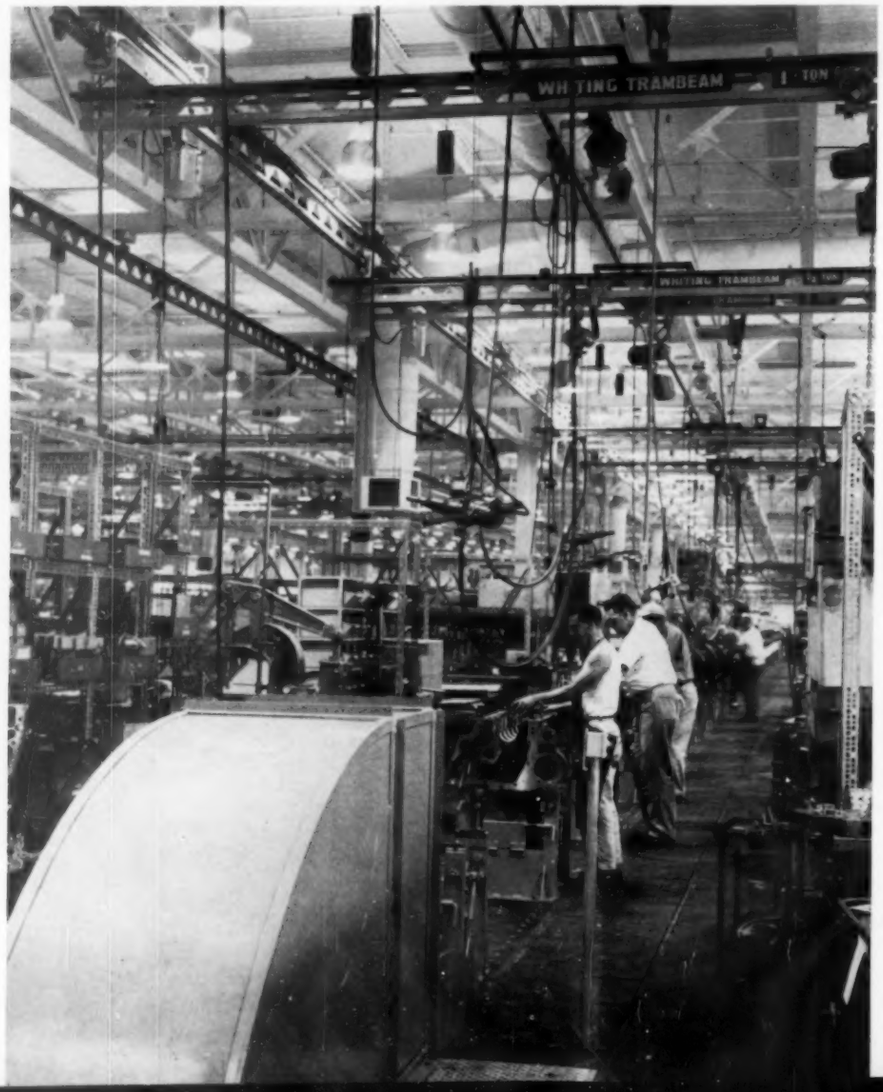
## Streamlined Production Starts at Massive New Engine Production Facility As Company Completes Another Major Part of Modernization and Expansion Program in Harvey

*By* ROBERT E. SCHULZ

HARVEY, Ill.—It's been said that diesels provide the heartbeat at this suburban Chicago city and with good reason. Here is located the sprawling engine production facilities of Allis-Chalmers Manufacturing Co. Last month, the heartbeat turned into a roar as engines started to move off five high-production assembly lines at the company's new, streamlined plant. Officially opened in September, the attractive one-story structure stretches out over 515,000 sq. ft.—over 11 acres—and employs the latest techniques, tools and equipment in engine manufacture. The plant's completion marks another giant step in Allis-Chalmers' modernization and expansion program at its Harvey Works—a $3½ million engineering and research center having preceded it in construction last year (see D&GEP Sept. 1960 issue).

The new plant, designed and built by H. K. Ferguson Co., Inc., took about a year and a half in construction—ground having been broken in April 1960. With dimensions of 1,100 x 440 feet, it's roughly the size of three city blocks. High beam construction is featured and the plant as illustrated is arranged for straight-through production with all machine lines feeding directly to the assembly lines and thence to the dynamometer test area. Also, the plant receives all raw materials and component parts for the engines at one end of the building and ships completed power plants from the other. Floor area that has been vacated in existing buildings has now been made available for expansion of material handling equipment production which is also carried on at Harvey.






During my visit at the plant, I discussed its design and production layout with General Manager at Harvey, Owen J. Higgins, and John Carlson, General Manager of the Engine and Material Handling Division. "We started planning this facility about mid-1957," Higgins stated, "stressing efficiency, quality control, plus built-in expansion features. Considering building expansion in overall design was a sound move since we anticipate a continuing growth of our own engine powered equipment plus a definite build up of markets for Allis-Chalmers diesels by other equipment manufacturers and users." Indicative of this, Carlson pointed to the company's new "thousand" series of diesels—"We have tried to match the entire facility to the production requirements of high efficiency, high output diesels plus gaining the latitude needed to expand our

**Cylinder blocks and heads flow to assembly lines, one of them shown at left, along with engine component parts machined in adjacent areas.**

**Engine blocks are bored, drilled and tapped on the Greenlee machines. Then the units pass the probing machines, one shown left foreground, which check holes for proper depth.**

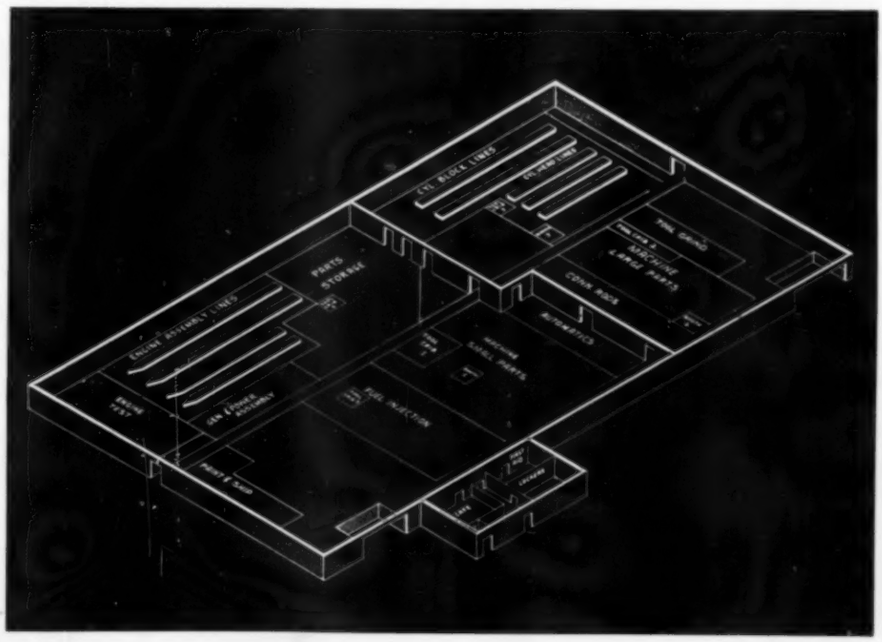
line in the more compact, smaller models for which markets are rapidly developing."

In total, over 600 machine tools are used in the engine plant, and 220 are completely new. A good number of these are concentrated in the block line which handles all blocks from the 844 cu. in., 21000 series diesels down. This line features the continuous process type of machining and is outstanding for its simplicity and product quality control system and equipment.

Looking at this process overall, all incoming castings are turned over to the metallurgical department for complete checking prior to production release. This includes Magnafluxing, template checking, and core testing of each foundry run. Blocks then travel by conveyor to the first machining operation which involves five continuous process hydraulic sequencing Kearney & Trecker milling machines. From milling, the larger and smaller blocks are split into two lines for boring, drilling and tapping on new multi-spindle Greenlees. It is interesting to note that along this entire line, Allis-Chalmers has installed an automatic underfloor conveyor that removes all chips. Also important are two steps that have been added in quality control. Following drilling, etc., all blocks are conveyed along their respective line to W. F. & John Barnes probing machines which in two steps check all holes for proper depth and air jet cleans each to eliminate chips, dust, etc. Following this, the block lines converge at a centrifugal spray machine which completely washes each block with an alkaline solution and dries it preparatory to final boring and finishing. In this final machining stage, the line again splits for the different size engine blocks; the finish cuts are accomplished; and the blocks again washed and dried before moving to the conveyor that carries them to the assembly lines.

As the plant layout drawing shows, all components and engine accessories are stored at the head of the assembly lines to reduce material handling and facilitate faster supply for the flow bin type of assembly used. Of the five high speed lines, four are automated, and the other is set up for production of power units, generator sets, marine engine-gear combinations, etc. The lines range from 250 to 300 ft. in length with diesels engines in assembly on three of these lines. The four automated lines are as follows: No. 1) B Series diesels; No. 2) B Series gasoline; No. 3) 6,000 through 11,000 Series diesel; and No. 4) 16,000 and 21,000 Series diesels. Present production capacity is 175 engines per day; however, according to General Manager Higgins, this varies depending upon the mix in the plant at any given time. Mr. Higgins then commented further on the expansion features of the plant, "With our setup here, we can double our present production capacity without approaching the tremendous investment of this facility. All plumbing, heating, and other services were installed at capacities twice our present requirements to make a move like this economically feasible. This, of course, is the reason why the production lines are installed in what would be called an 'off-center' location."

As assembly is completed, the engines are picked up by a motorized overhead rail conveyor and carried to the large dynamometer testing room. In the event all the test cells are occupied, the conveyor is designed with a loop to temporarily store excess engines. The diesel testing area, with 34 completely instrumented dynamometer cells plus three others with electrical dissipation equip-




**Floor plan of the new Allis-Chalmers engine plant. Note straight through type of production.**

John Carlson, (left) general manager, of the Engine and Material Handling Division, and Owen J. Higgins, general manager at Harvey, discuss the new plant, background.

ment for generator sets, is another outstanding feature of this new plant. Objective by Allis-Chalmers in the design of the cells was to establish full-scale laboratory testing on a production basis—this the company has achieved. The panels and instrumentation were developed and produced by Minneapolis-Honeywell working in conjunction with A-C plant engineer, James Wagner and Nick Deenik, electrical engineer. The dynamometers, of the water-cooled, eddy-current brake type were built by Eaton's Dynamatic Division and include the dyna-torque clutch for motoring the engines in starting.

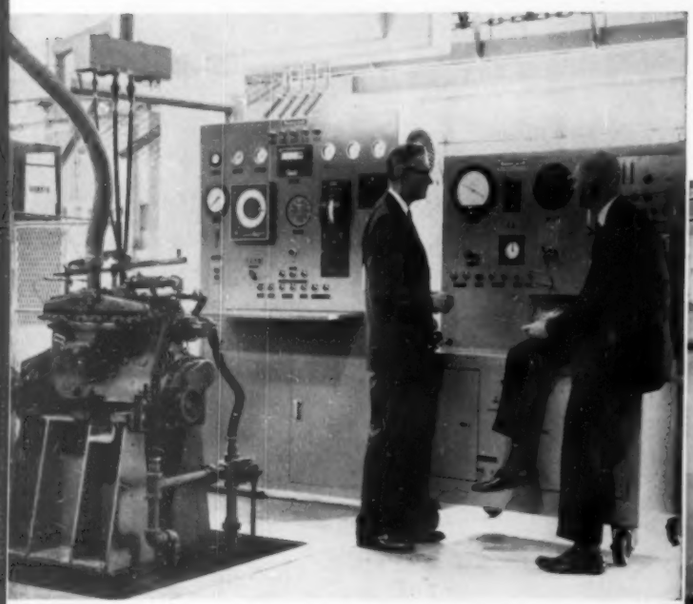
Rigid controls were set up and systems installed to maintain engine intake air at 70° F ambient, and engine cooling water at an entering temperature of 140° F. To achieve the desired air temperatures, two separate, yet interlocking, systems are used. Basically, all incoming air is filtered and enters the cell at floor level passing up the side of the diesel to exhaust plenums. Should heating of the air be required, the incoming air is bypassed through baffles on the exhaust snubber and then directed into the test cell. Similar control of dynamometer cooling water is effected so that water to brake is maintained at 100° F.

The control panel in each cell is exceptionally complete. Not only do the boards have the required complement of gauges and meters for pressures and temperatures, engine speed, elapsed time, etc., but two new instruments have been added—one for automatic computation of specific fuel consumption, and another for direct reading of brake horsepower output. The former is accurately achieved through an intricate system of controls which compute fuel viscosity and temperature, water temperature, speed, and all other variables that must be considered in accurately measuring consumption.

The diesels are held on test for two to four hours and normally go through four check points: 1.) top speed, full load (1625—2200 rpm); 2.) decreased speed, normally 4-5 check points below top speeds using 100 rpm increments; 3.) low idle —high idle with check of governor repeatability at full load speed; 4.) general exterior check of engine for leaks, etc.

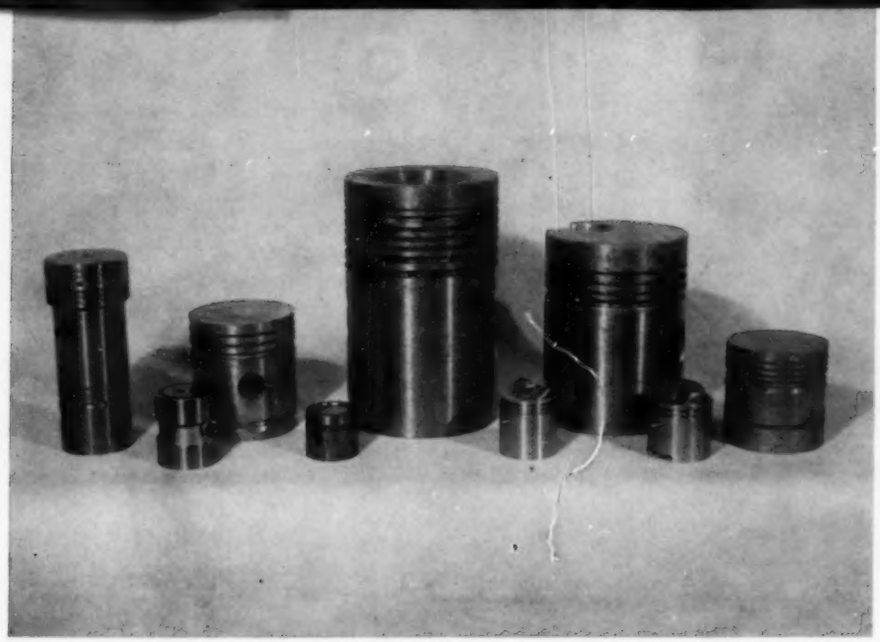
To maintain a positive check on accuracy of all test instruments, Allis-Chalmers uses a calibrating cart also developed by Minneapolis-Honeywell. This cart can be moved to any of the 34 test cells and actually simulates all temperatures, pressures, and speeds, weighs fuel and performs all other functions necessary to test and calibrate the instrument panel.

The new plant characterizes the continuing changes that have been made at Harvey since Allis-Chalmers purchased the Buda Company in 1953. With its efficiency and high productive capacity, the plant is well tailored to produce the company's line of engines for its own farm, construction, and material handling equipment, as well as for the many other markets its diesels serve. Truly there is a roar at Harvey and it's coming from this "house of horsepower."



Jim Cameron, left, assistant works manager at Harvey shows Managing Editor Robert E. Schulz operation of the Minneapolis-Honeywell calibrating cart which checks accuracy of instruments used in the test cells.

Engines produced at Harvey are tested in this battery of dynamometer test cells. A total of 34 cells for engine test and three for generator sets are installed. Each cell automatically computes specific fuel consumption and direct horsepower output.



These pistons for various types of engines were cast from Vanasil.

# HYPEREUTECTIC SILICON ALLOY FOR PISTONS

PISTON alloy research, along with investigations into other major engine components, occupies the efforts of many metallurgists in the industry in a constant search for the "ideal" material. High output engines continue to place heavier stresses on their parts, adding a constant spur to match the makeup of the component to the use requirement in engines.

In the case of piston research, engineers generally envision the ideal material to be one that combines the thermal conductivity and light weight of aluminum with the wear resistance and elastic modulus of cast iron. The piston, as well as the cylinder, is an application requiring an alloy with low coefficient of expansion, high hardness and wear resistance along with maintenance of its physical properties at the high temperatures to which it is subjected.

A material that has played an important role in advances in the art of piston making is an alloy produced in this country for something over 20 years and which today looks to find increasing application in the new high output diesels. This is a hypereutectic silicon aluminum alloy marketed under the trade name Vanasil by Gillett & Eaton, a member of the GN Engine Parts Division of Gould-National Batteries, Inc. A eutectic silicon alloy contains up to approximately 13 per cent silicon. The hyper eutectic may go as high as 30 per cent. The excess silicon remains in the matrix and resists wear when the piston rubs against the cylinder wall, thus forming a low coefficient of friction. The Vanasil alloy ranges from 21 to 23 per cent silicon. In the Vanasil alloy, a volume of finely divided and uniformly distributed graphitic silicon provides an efficient and long wearing bearing surface. The effect of this hypereutectic silicon and the highly alloyed matrix upon the physical properties, particularly in regard to its use as piston material, is interesting and significant.

Bearing and wear resistance is increased because of the increased antifrictional properties imparted by the silicon. A film of oil is maintained by the microscopic porosity established in the matrix of the alloy and, in addition, the graphitic silicon particles, like the graphitic carbon of iron, also absorb oil around them. Between the two properties, they provide a condition which, even under adverse conditions, holds lubrication present on the bearing surfaces.

Thermal expansivity is highly important in aluminum piston applications since efforts of designers have been directed to minimizing the higher rate of thermal expansivity in relation to the cast iron cylinders in which the pistons operate. The Vanasil alloy, wth a thermal expansivity of .000016 in./Lin. in./°C is close enough to cast iron to allow effective use in most design situations.

According to G&E engineers, pistons of their hypereutectic silicon aluminum alloy do not require use of T slots, split skirts and inserts in order to overcome expansion difficulties.

Though developed primarily for pistons in internal combustion engines, applications of the alloy have extended in recent years to precision instruments that are subject to wide variation of temperature. Extensive research and applications in the field for large diesels have indicated Vanasil can seek uses in cylinders, cylinder sleeves, cylinder blocks and castings when the properties of the alloy match the requirements of the application.

In the small air-cooled engine industry, pistons made from Vanasil have proved popular. Manufacturers have found they are able to increase horsepower with the closer fit permitted by Vanasil's low coefficient of expansion, the lower friction ratio against the cylinder wall and the "oil absorbing" surface of the Vanasil alloy. This is particularly true at the higher speed and temperatures, report G&E engineers.

Summing up, Vanasil offers possibilities in piston applications for high speed and higher output diesels since it is a light alloy with a low expansion characteristic and high dimensional stability; has normal heat conductivity similar to previous aluminum alloys; can be fitted to solid skirt design because of its micro-expansion feature and can also be fitted to cylinders with minimum clearances between cylinder wall and piston.

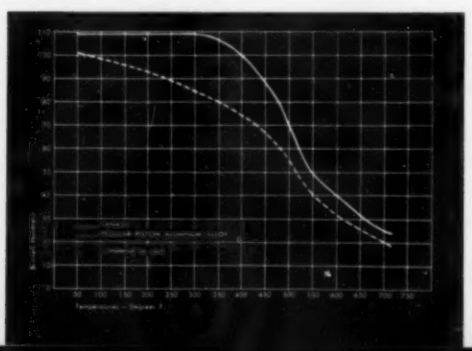
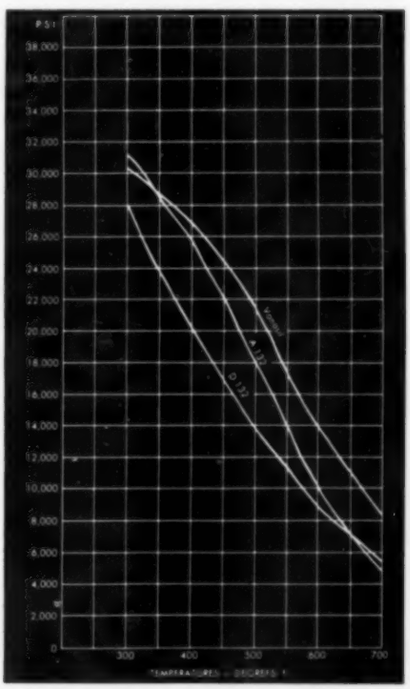
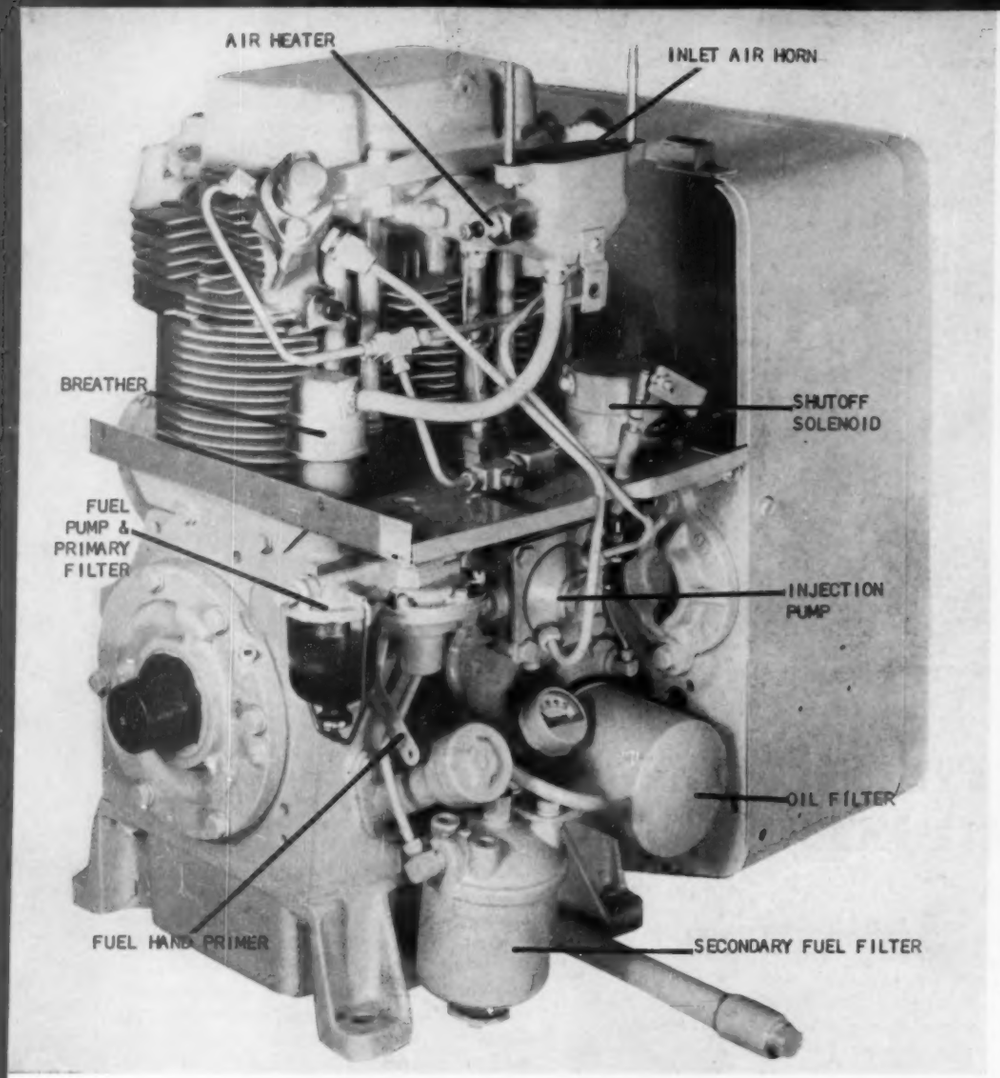


Chart shows effect of Brinell hardness on aluminum alloys at elevated temperatures.




Comparison of tensile of heat treated aluminum alloys at elevated temperatures.




**View of DJ-60 two cylinder diesel engine at left shows location of components and accessories for easy servicing. One and 4 cylinder engines have similar arrangement. Four cylinder DJ-120 diesel is shown below. Note clean lines of engine, blower housing. The only accessory on this side of engine is the starter.**

# ONAN'S NEW DJ SERIES OF 5 TO 24 HP DIESELS

THROUGHOUT the vast range of engine power users the word is being spread—"be alert to and watch the smaller horsepower diesel for greater economy and application flexibility." This is well taken for indeed the small diesel is moving rapidly into the field and bringing with it low cost operation and maintenance. One of the builders of these "mighty mites" responsible for this move is the Onan Division of the Studebaker-Packard Corp. This Minneapolis company has just started production of an entirely new family of air-cooled diesels for its line of electric generating plants and for general engine applications. The engines, in three basic models ranging from 5 to 24 bhp, provide Onan with excellent application versatility and a high degree of parts standardization.

Development of the DJ Series family, as these engines are designated, began several years ago "Customers had begun to ask for features and performance which we could not give with our present line of generating plants," stated Dave Onan II, manager of Market Planning. "We began to look ahead to anticipate our requirements. New markets demanded better operation and reliability—electric generator performance was becoming more exacting. Voltage control and response to load changes was becoming more critical, and the economies of saving weight, space, and material much more important. Electric plant operation is continuous and heavy duty service and our life and reliability requirements are virtually the same as larger industrial engines."

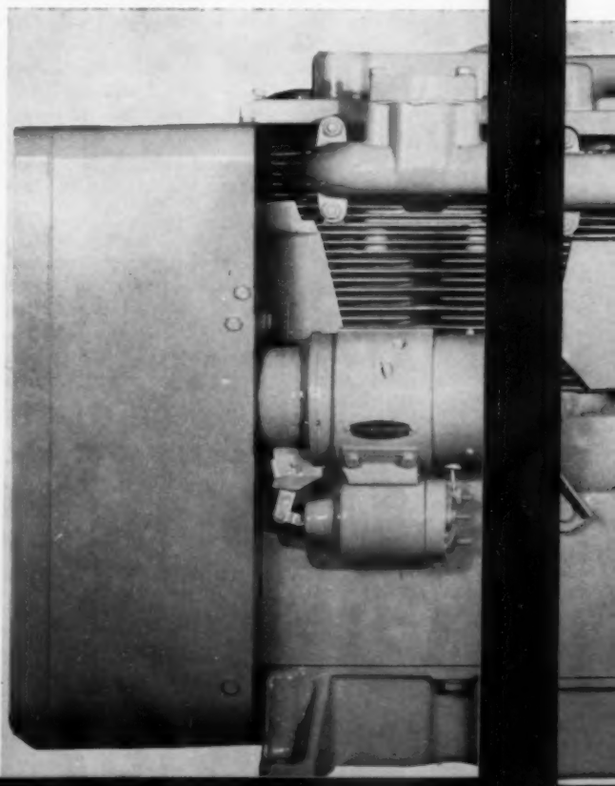
These considerations plus many more were used by Onan engineers to establish design goals for subsequent development and production of the J Series. This series consists of six diesels, and with an interchangeable design employed, six similar gasoline engines. They are built in air-cooled and marine water-cooled versions in one, two, and four-cylinder models, with 30 cu. in. per cylinder. All are in-line vertical engines, a first for Onan, and are of the four-cycle type with a 3¼ in. bore and 3⅜ in. stroke. Height of all diesels is 24½ in. Weights and lengths, including starter and flywheel alternator, are:

| | Weight | Length* | Width |
|---|---|---|---|
| DJ- 30 (1 cylinder) | 240 lbs. | 21 1/16 in. | 18 in. |
| DJ- 60 (2 cylinder) | 277 lbs. | 23¼ in. | 17⅞ in. |
| DJ-120 (4 cylinder) | 450 lbs. | 34⅜ in. | 19⅛ in. |

*Includes 4" stub shaft

A key principle in the design of the J Series engines is standardization of parts and tooling throughout the family. Many parts are interchangeable for all engines, and tooling used to make similar pieces, such as crankcases, for three different engines is the same. These universal parts would include valves, gears, connecting rods, bearings, rocker arms, push rods, and tappets. Amongst engines of the same number of cylinders, crankshafts and camshafts are interchangeable. In non-working and accessory parts, there is also a great deal of standardization. Much of the sheet metal and the blower housings is similar, if not identical. Accessories such as fuel pump, oil filter, starter and generator are common to all engines.

In the DJ family, the variety of cylinder heads are machineable on common tooling. To do this, the four-cylinder engine uses two of the two-cylinder engine cylinder heads. Single-cylinder engines have a cylinder head of their own. Hole centers and port spacings are the same on the one and two-cylinder cylinder heads for air-cooled and water-cooled gasoline and diesel engines. Variations to allow for the gasoline and diesel engines are accomplished by placing the diesel

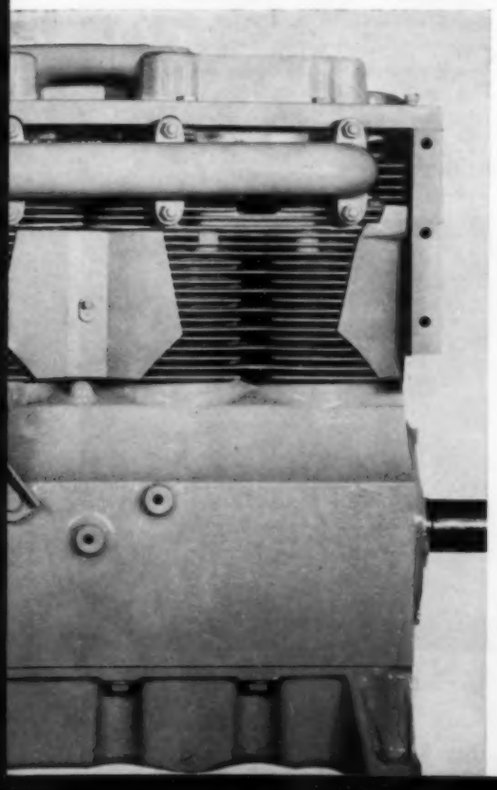


pre-combustion chamber and nozzle assembly in roughly the same position as the gasoline engine spark plugs are placed.

Easy service and low maintenance are goals of every engine manufacturer. Onan's major effort in this regard was to place accessory items where they are easily accessible for service. All routine service can be accomplished from one side of the unit. On this access side is located the oil fill, drain and check points, the fuel pump, oil filter, oil pressure gauge, injection pump and nozzles. Governor speed and droop adjustments are accessible from that side, and valve lash may be adjusted from that side if there is room to raise the valve box cover over the valve mechanism. The only accessory on the other side of the engine is the starter unit.

The engine design features an interesting low cost and compact fuel injection pump and governor built by American Bosch and designated model PSU. This injection pump delivers fuel under high pressure to injectors with 1750 psi opening pressure. Fuel delivery, full load and shut-off are regulated by the axial movement of the plunger metering sleeve which is controlled by the operating lever on the outside of the pump. The pump mounts on a pad on the access side of the engine and is piloted in a hole which is on the camshaft center line. The complete injection pump, including its gear and tappet, are mounted on the engine as an assembly.

The distributor injection pump is designed to accommodate either two or four-cylinder engines and is made with either two or four outlets. By using this system of closely integrating the injection pump with the engine, and not considering it an add-on accessory, the cost of the injection pump itself is cut by more than half. At the same time, this injection pump needs no adjustment by the operator, and can be removed as a unit for service. High pressure lines carry fuel from the pump to injection nozzles located in the cylinder head.



The combustion system is of the pre-combustion chamber type. The pre-combustion chamber is shaped roughly like half an egg. The relative volumes of the pre-combustion chamber and area above the piston are about half and half. The bottom side of the cylinder head is flat, and the piston is flush with the top of the cylinder at top dead center of the crankshaft. A hole which is not concentric with the axis of the pre-combustion chamber connects the pre-chamber to the area above the piston. Glow plugs and air heater are standard equipment for cold weather starting.

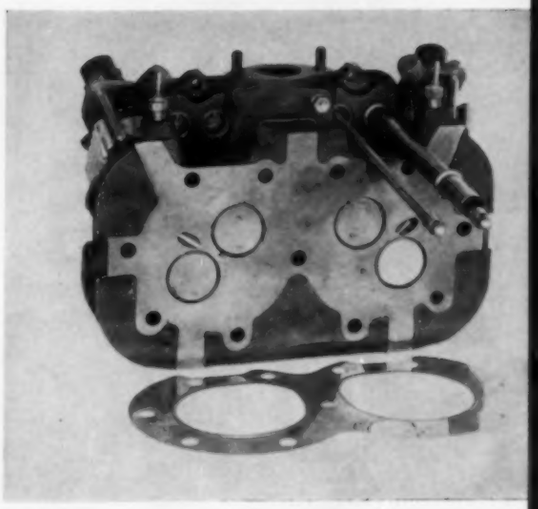
The injection nozzle is located concentrically with the pre-combustion chamber. Between the pre-combustion chamber and nozzle is a steel washer which acts as a heat shield. The nozzle holder is set in a finned aluminum adapter which provides cooling for the nozzle. The pintle-type nozzle runs cool and has self-cleaning characteristics. Combustion chambers in the water-cooled and air-cooled heads are identical. The position of the nozzle is the same, except that the water-cooled engine does not require an adapter for the nozzle to keep it cool.

The water-cooled diesel and air-cooled diesel cylinder heads are of cast iron to resist corrosion and for the added strength of the material.

Intake and exhaust ports are on opposite sides of the cylinder head. Intake ports are Siamesed within the head itself, and the exhaust ports are separated. In air-cooled versions, cooling air flows from the intake side to the exhaust side of the head so that exhaust ports and exhaust manifolds do not heat the cooling air before the air does its work. Intake and exhaust valve seats are solid Stellite and the exhaust valve is Stellite-faced. The valve deck at the top of the cylinder head contains the rocker arms and valve mechanisms with their associated parts. The rocker arm is of stamped steel, with a ball socket pivot. One stud through the center of the ball anchors the rocker arm to the cylinder head. The valve gear is conventional for this type of engine with push rods operating the valves through stamped steel rocker arms. Valve lash is adjustable by a single nut on the rocker arm pivot.

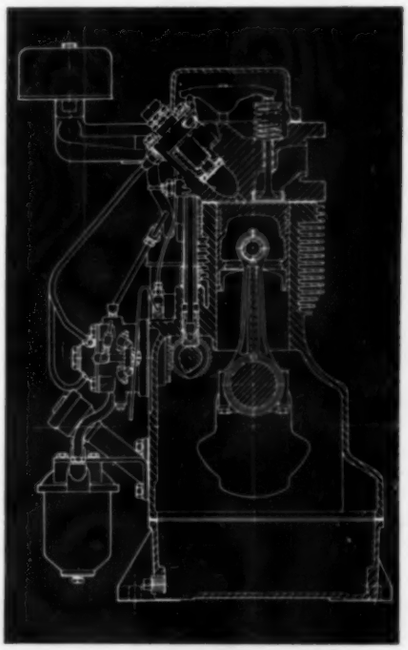
The air-cooled engines are cooled by fins on the flywheel, which is located at the end of the engine opposite the power take-off end. Cooling of the water-cooled engine is by means of a rubber impeller pump to circulate sea water through the water jacket, or act as a sea water pump when heat exchanger cooling is used. With heat exchanger cooling, there is the addition of a jacket water circulating pump. Water temperature in the block is maintained by a thermostat with an internal bypass system built into the cylinder head. In the case of the four-cylinder engine with two cylinder heads, there are two thermostats. The two and four-cylinder marine engines have water jacketed exhaust manifolds. On the one-cylinder marine engines, the outlet water is dumped directly into an exhaust elbow.

Onan chose to use ductile iron as a crankshaft material because they determined from experience on their previous engines that it has nearly the strength of a steel forging, but allows changes

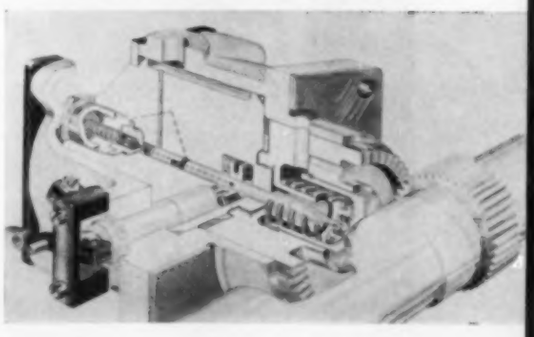


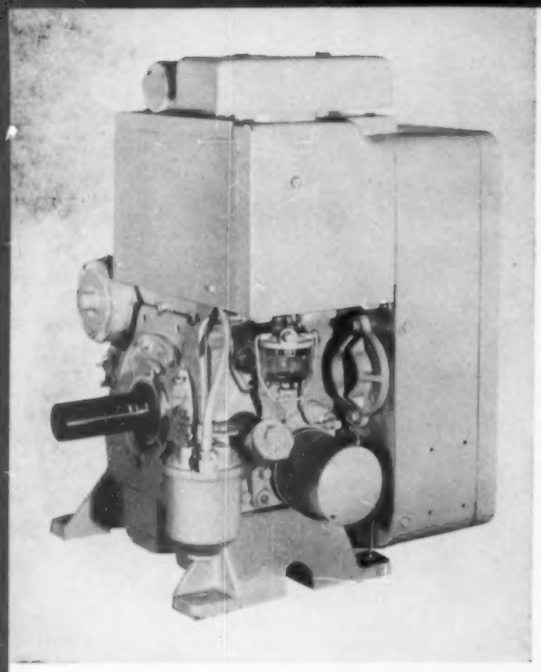
**Common cylinder head is used for two and four cylinder engines. Intake valves are above, exhaust valves below, and pre-cup opening is between. Valves are push rod-operated.**

**Cross section drawing of J Series engine. Note combustion chamber, nozzle arrangement.**

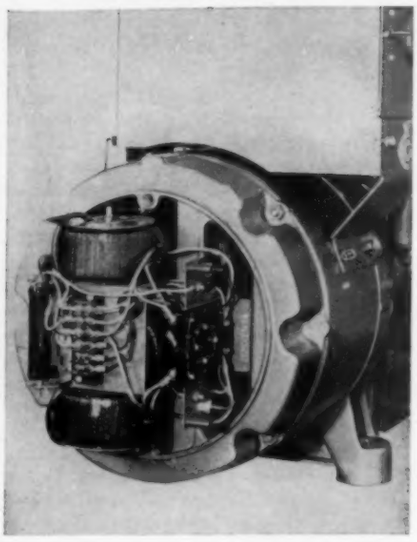


**American Bosch PSU injection pump is used on Onan J Series engines.**





**DJ-30 diesel is single cylinder engine, shown here with air cooling housing installed. Note clean lines of housing.**



**Rear view of 6 kw statically excited revolving field generator. This generator, used on all Onan sets for 6 to 15 kw, is shown here with dust cover removed. Exciter, voltage regulator are built as part of generator package.**

in design without costly die modifications. Onan drills a hole down the crankshaft center to distribute stresses over a broader area and take them away from connecting rod journal fillets. Crank pin fillets are shot peened to induce a compressive force in that area.

Connecting rod design is basically an I-section beam. Rods are heat-treated to give added strength and are drilled to provide lube oil to the pin and for piston cooling.

Overall length of the engine crankcase is determined primarily by the cylinder spacing required to get air between the two cylinders of the two-cylinder engine. However, it was also influenced by the placing of the diesel injection nozzles on the four-cylinder engine, since the nozzles for the two middle cylinders point toward each other at a 45° angle. A heavy steel plate at the front of the engine crankcase forms a back for the gearcase, supports accessories such as the engine starter, and also serves as a support for the blower housing and many other parts.

Cylinders are integrally cast onto the crankcase. The crankcase is deep-sided, going below the center line of the crankshaft and connecting directly to the oil base. Bearings are full round bushings. On the four-cylinder engine, the center main is carried in a split bearing carrier. Long screws through the bearing carrier clamp it together and hold it into the crankcase. In all cases, crankshaft thrust is taken on the ends of the crankshaft by thrust bearings pinned to the crankcase to prevent rotation. Main bearings are lead bronze. The rear bearing plate is piloted in the crankcase, contains the rear bearing and oil seal. The front bearing is pressed into the crankcase, but the front oil seal is in the gearcase.

Oil is piped to the center and rear main bearings through steel tubing which is pressed in place. In the center main bearing, a hole is drilled in the bearing carrier to supply oil to the center main. The only difference in the machining of the gasoline and diesel engine crankcases is the added holes needed to mount the diesel injection pump on the diesel crankcase.

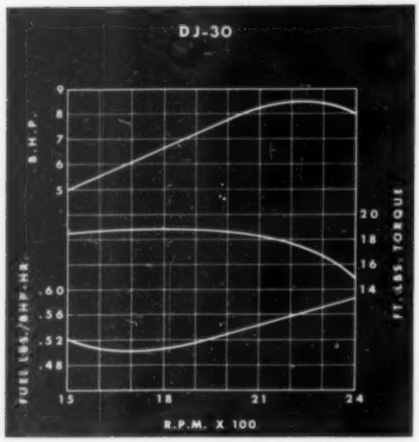
Onan has designed into the DJ Series engines provisions for full flow lube oil filters. The filter is a standard replaceable cartridge type. Provision is also made for a bypass type filter if desired. Primary and secondary fuel filters are standard equipment. An oil bath air cleaner is optional on the engines.

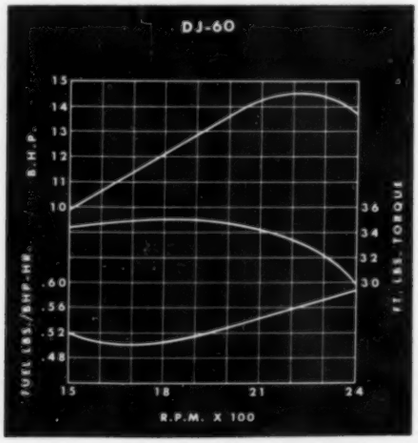
The engine oil pump is of the spur gear type, located at the front of the engine crankcase. The input shaft gear of the oil pump meshes directly with a gear on the crankshaft. The pressure regulator is located in the rear bearing plate of the engine which is furthest downstream from the oil pump. Bypass oil flows directly back into the engine crankcase.

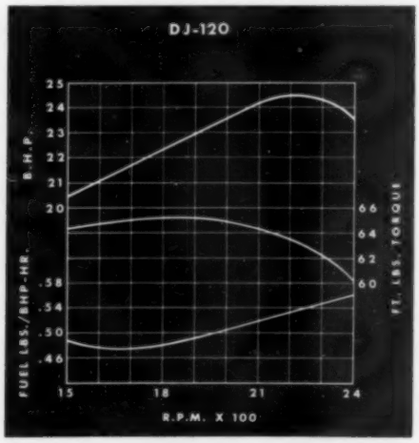
The DJ Series diesels have been designed with a variety of starting options. The single-cylinder diesel may be hand cranked. Where the starting is done by a push button on the unit, the conventional Bendix drive starter system is available. When the engine must start unattended, such as a generator set with an automatic line transfer, or a refrigeration unit on an OTR truck, a solenoid shift starter is available. On electric sets of 5 kw rating and less, the generator can be utilized as a cranking motor.

Commenting on the economies of the new DJ Series, Dave Onan said firm prices for the diesels have not yet been established. "We can see, though, that the price of the diesel will be about 60% greater than its gasoline counterpart," he said. "This is due primarily to the injection equipment, the extra fuel filters, an electric solenoid to shut the engine down, and the shot peening of the crankshaft." Thus these new smaller horsepower diesels are definitely in the range which offers economy of diesel operation in small industrial and marine engine applications where this economy in comparison with gasoline engines will offset the higher initial price of the diesels.

**Power and fuel consumption curves for, from left, Onan DJ-30, DJ-60 and DJ-120 diesel engines.**



One of the two Caterpillar D375 diesel engines which will power the Kato 500 kw generator is lifted (circle) to the 61st floor of the Chase Manhattan Bank building.

# TWO CATS IN A BANK

SIDEWALK superintendents in Manhattan's Wall St. district were given a treat recently as they watched a crane mounted 61 stories above the street lift units of a 36,000 lb. emergency diesel generator set to the roof of the new Chase Manhattan building. This 813 ft., $135 million skyscraper, the world's sixth tallest building, has 60 floors above ground and five below ground level.

The need for emergency standby power was forcibly driven home in Manhattan during New York's power blackout in 1959. The bank was interested in standby power for two emergency reasons: to return power to security devices in underground vaults during outages and to evacuate people from the building in 46 automatic elevators. Serving all 60 floors, these elevators also handle traffic in the five below-ground floors. Power was needed to run these and to furnish lighting in crucial areas throughout the entire building. This includes all exit signs and lighting on stairways, one lamp for every 2000 sq. ft. on the underground levels and one lamp in each passenger elevator.

The power package installed at the top of the building to fill these needs consists of two Caterpillar D375 diesel engines between which is mounted a 500 kw Kato generator. These components in turn are mounted on a specially designed 36 ft. base and metal housing resting on vibration dampers attached to the main columns of the building. The entire unit was furnished by H. O. Penn Machinery Co., and after testing was disassembled for lifting in sections.

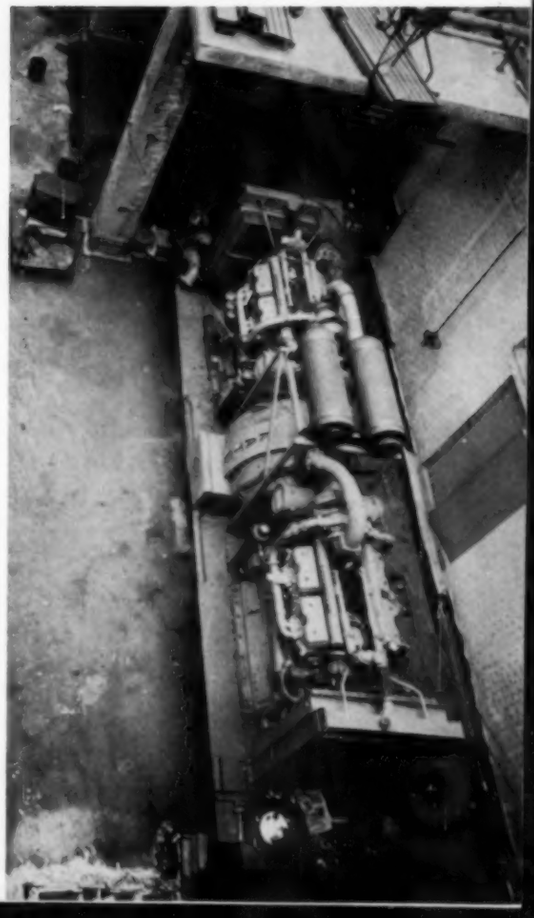
The D375 engines are turbocharged, V-type, 8-cylinder diesels with 5¾ in. bore and 8 in. stroke and rated 525 hp each. They are connected to the Kato generator through Morse clutches and couplings. The ac generator is rated 500 kw, 480 volts at 1200 rpm. Engine speed is controlled by Woodward governors.

Two 6 kw heaters were installed in each engine to maintain jacket water at a temperature that would allow instant starting. The engine can be started electrically by an automatic start-stop system after a three second power outage. If either engine fails to start or shuts down during operation, it will be disengaged automatically from the line and the generator load borne by the remaining engine.

Nearly 15,000 persons will work in the new Chase Manhattan Bank building. The bank will occupy the 28 lower floors plus the dining room on the 60th floor. Tenant occupancy will be on 27 floors with the balance of the floors utilized as machinery rooms.

Sale of the two-engine electric set to the Chase Manhattan Bank helped develop another sale for a similar purpose. Contractors involved at the bank also had contracts on a midtown job and H. O. Penn sold a 245 kw, D353 electric set for installation on the 15th floor of the new Equitable Life Assurance Society building.

On the 61st floor (roof) of the new skyscraper in downtown New York City the two Cat diesels are shown mounted on a specially constructed 35 ft. base. Kato generator is mounted between them.



**For Consolidated Freightways, Inc., . . .**

# MODERNIZATION AND MAINTENANCE MAKE THE BIG DIFFERENCE

*By* JIM BROWN

CONSOLIDATED Freightways, Inc., a trucking firm which has experienced phenominal growth in the last few years, has been undertaking a system-wide fleet modernization and replacement program which involved placing nearly 2,000 new units of various kinds into service.

Specifically the new equipment, most of which was intercity equipment involving diesel traction, included more than 200 new power units. Of these, 13 were big turnpike cruisers for use in double-bottom service. Among the new intercity power units placed in service were 164 long wheelbase and short wheelbase diesel "sleeper" tractors, plus several gasoline tractors and tank trucks.

Coincidental with the power replacement Consolidated Freightways replaced nearly 1000 over-the-road trailers with new ones, including dry vans, reefers, flat beds with side racks, open-top vans, hoppers, tankers, low beds and a number of specialized units. Lengths of CF trailers vary from 27 to 40 ft. Among the new units placed in service were over 200 refrigeration units (mostly TransiCold—some diesel). For in-city service 153 new trucks, 105 tractors and 168 trailers were put into service in 1960.

Because Consolidated Freightways is so vast, and is growing almost continuously it is next to impossible to obtain an equipment list of which you can say "This is it" and still be "up-to-the-minute" accurate. However, the equipment listed by the Menlo Park, Calif. headquarters of CF recently was as follows:

CONSOLIDATED FREIGHTWAYS EQUIPMENT

| | |
|---|---|
| Intercity trucks | 238 |
| Intercity tractors | 1,408 |
| Intercity full trailers | 268 |
| Intercity semi-trailers | 4,228 |
| Pick-up trucks | 985 |
| Pick-up (and shuttle) tractors | 1,243 |
| City trailers | 1,074 |
| Service cars | 138 |
| Passenger cars | 106 |
| Total CF automotive units, | 9,688 |

At the time the above was compiled it was reported to us that no quick count of the diesel trucks and tractors was available but that the majority of the "intercity" trucks and tractors were diesel. From this it would be safe to assume that Consolidated may own as many as 1,500 diesel trucks and tractors. The majority of these are powered by Cummins diesel. The new "double bottom" toll road units are Freightliners and White diesel tractors with 335 hp Cummins engines. Cummins NH-220 engines are also used widely by Consolidated.

William G. White, president of Consolidated Freightways, said that the fleet modernization and replacement program embraced CF's dry freight and reefer service (which serves major markets in 32 states including Alaska and Hawaii); the company's bulk commodities operations, city pick-up and delivery service and its Canadian Freightways subsidiary operations in five provinces and the Yukon Territory in Canada. "Good, clean equipment in good repair is essential to expeditious service for our customers" said Mr. White, "It has been our goal in our fleet modernization

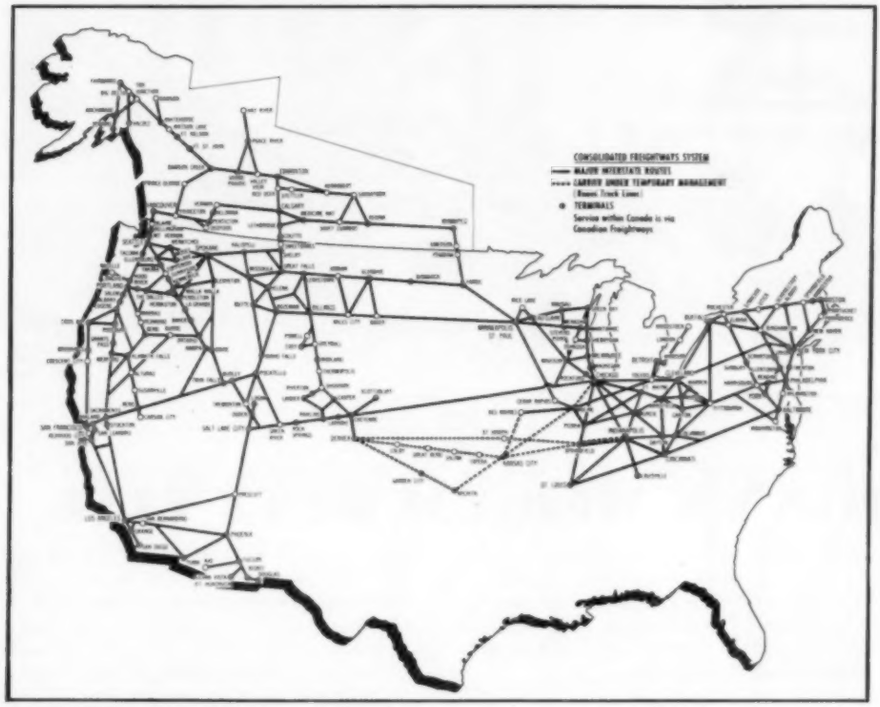
William G. White, president of Consolidated Freightways.

Going into action—one of Consolidated Freightways new equipment units, a double-bottom reefer with 375 hp Cummins powered Freightliner tractor. CF placed almost 2,000 new pieces of equipment of various types in its nation-wide fleet in 1960.

program to provide the shipper with the best in general and specialized equipment that will suit every conceivable need".

This huge transportation complex, now handling almost every conceivable type of hauling assignment domestically or with overseas destinations, grew out of a small Portland, Ore., group which in 1929 founded a firm called Consolidated Truck Lines under the direction of Leland James, now retired, but still founder-chairman of the board of Consolidated Freightways. CF's growth is fascinating and a story in itself; yet unfortunately space does not permit us to cover that phase. As an indication, however, just since 1946 its acquisitions have included several Canadian trucking firms; Garrison Fast Freight, which serves Alaska by land and sea; the Freightliner Corp. which builds trucks marketed by the White Motor Corp., and which also has owned the Transicold Corp. since 1959. In 1958, Consolidated Freightways, Inc., acquired Transcontinental Transport, Inc., of San Francisco, which leases railroad tank cars. In 1960, the company acquired Motor Cargo, Inc., of Akron, Ohio and Liberty Motor Freight Lines of Secaucus, N. J. Integration of these operations into the CF system stretched the companies routes to the Eastern Seaboard, making CF a transcontinental operation, serving nine of the nation's ten largest metropolitan areas and 32 of the 50 largest cities with both long-haul and short-haul service.

**Consolidated Freightways' complete, well-organized and illustrated Maintenance Manual.**




**The broad coast-to-coast and border-to-border interstate route coverage of Consolidated Freightways, Inc., is shown on this map of their system.**

The phenomenal growth and sustained success of Consolidated, is perhaps best illustrated by the fact that reported net income after taxes grew from $34,367 in 1930 to $1,732,415 in 1958. Operating revenue in the same period grew from $866,914 to $84,849,622—a growth of nearly a hundred-fold.

Several months ago we also met with Mr. E. B. Ogden director of maintenance of Consolidated's dry freight operations west of the Mississippi. Mr. Ogden told us that among the many other "firsts" with which Consolidated Freightways is credited (first to develop a method of recapping pneumatic tires, first to service equipment on a production line, first to rebuild transmissions and other equipment units, etc.) CF was among the first to seriously consider the advantages offered by diesel engines for trucking. This first Cummins diesel, installed in 1933, was scoffed at by the industry as being an impractical innovation. "In fact," says Ogden,"a complete trip with a diesel without a breakdown was a rarity for the first few months, but our faith in the future of this type of power was soon vindicated."

Mr. Ogden's responsibility in trying out and initiating new equipment and maintenance methods covers everything from bumper to tail-light on all of the rolling stock, trailers as well as trucks and tractors. At the time of our chat he was supervising tests on such things as automatic lubrication of chassis points and extended service from universal joints. He reported getting as much as 50,000 miles on universal joints (1700-1800 series Spicer) without repacking.

Consolidated Freightways publishes a "giant" manual to guide the maintenance and repair operations in its shops. It runs over 400 pages and there are 32 chapters, of which nine are devoted to service (power unit service, trailer service, refrigeration service, etc.). The remaining 23 are devoted to disassembly, repair, reassembly and adjustment of the 1001 parts which go to make up the body, motor, brakes, electrical system, transmissions, differentials, clutches, springs, fifth wheels, steering gear and other assemblies commonly encountered in Consolidated equipment. It also illustrates and explains the various recommended forms: service forms, rebuild forms, test forms, unit service records, etc.

When Consolidated acquires a new company they do not cram their standards of maintenance down the throats of shop personnel, but instead they make such things as the CF Maintenance Manual available to them. Since such materials and training generally prove to be superior to those previously available to maintenance personnel of the smaller companies they are usually snapped up and put into effect very quickly. Thus is carried out one of the general aspirations of the company —to render better service to the shipper by improving equipment and improving equipment maintenance to a degree that would not have been possible to any of the dozens of smaller firms who have come under the influence of their management.

**Entry into the diesel field with 15 medium duty models is a highlight of 1962 Chevrolet truck line. Diesel engine used is the four-cylinder GM 4-53 developing 130 hp.**

# DIESELS IN CHEVY'S MEDIUM DUTY LINE

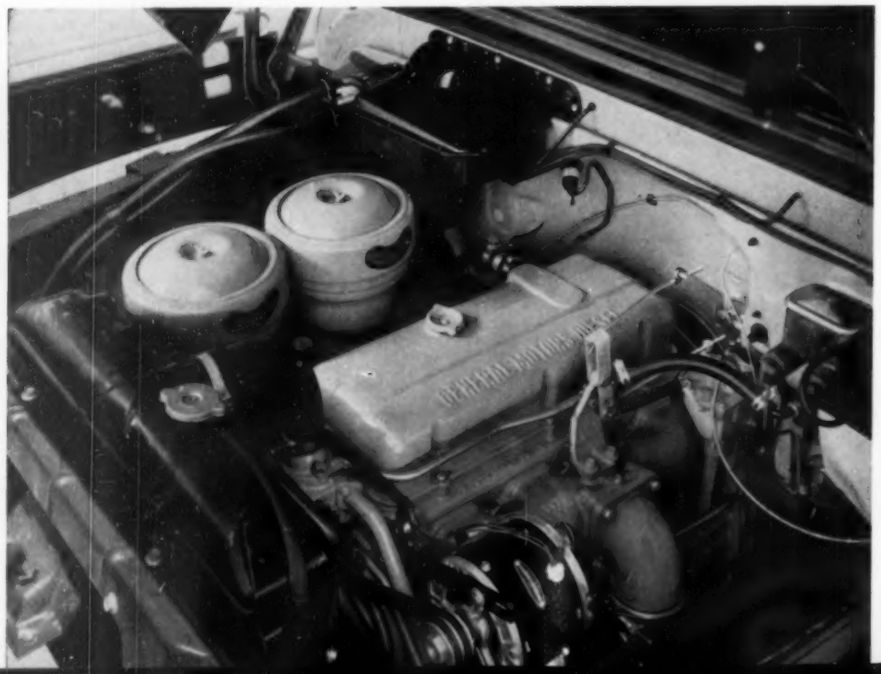
CHEVROLET has entered the diesel truck field with introduction of its medium duty models in the 1962 line. The diesel trucks consist of 15 conventional cab models on five wheelbases ranging from 133 to 197 in. with cab/axle dimensions from 60 to 124 in. Gross vehicle weight range is from 15,000 to 23,000 lbs.

The diesel available in the new Chevrolet truck models is the GM 4-53 engine, a four cylinder, 212 cu. in., in-line two cycle unit which develops 130 hp and 271 lb/ft. of torque.

The new model lineup, including the diesel units which are the first in their range offered by Chevrolet, is the widest in the Division's history, according to James E. Conlan, assistant general sales manager for trucks. "The need for more models designed for specific hauling jobs is typified by our entry into the growing diesel market in the medium--and heavy-duty fields," he stated.

Included as standard equipment with the engine is a Delco-Remy 12 volt alternator. Suspension systems for the new line have undergone minor modifications for increased durability and capacity, according to Chevrolet. For extreme off-road operations, two new extra-heavy duty optional I-beam front suspensions with leaf springs are available for most models.

Several major chassis improvements have also been made in the new Chevrolet line. K-frames formerly used on long wheelbase medium and heavy-duty models are replaced by laddertype frame for mounting back-of-cab equipment.



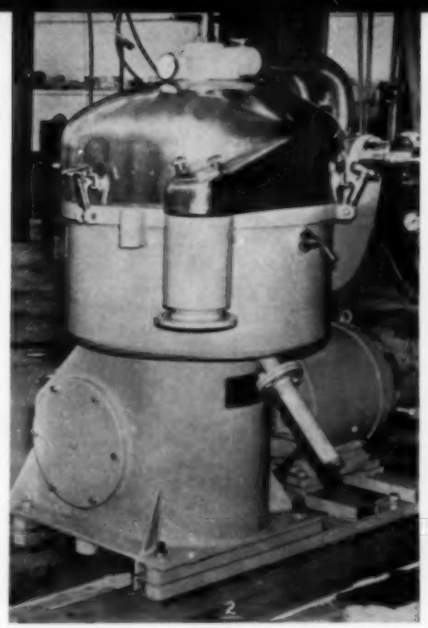
**Four cylinder GM 4-53 diesel fits compactly into engine compartment of Chevrolet medium duty truck. This is first diesel to be factory-installed by Chevrolet in their truck lines. Delco-Remy 12 volt alternator is standard equipment.**

# SPECIAL OIL PURIFIER ENTERS MARKET

A SPECIAL design, high-capacity separator developed for the U. S. Navy for jet fuel purification has now been released for commercial applications. Capable of separating sea water, solids and other sources of contamination from jet fuel and other products at a rate of 12,000 gals. per hr., the purifier is manufactured by De Laval Separator Co. Commercially the purifier has a good range of application and is especially well suited in the power industry for the purification of lubricating oils and elsewhere throughout industry for applications involving liquid/liquid or liquid/solids separations.

Success of the oil separator is due in part to the successful forging by Wyman-Gordon Co., of the bowl shell, coupling ring and bowl top for the uncommon stainless steel, type 329, and the coupling nut and tubular shaft from type 316 stainless. In development by DeLaval for four years prior to Navy acceptance, the purifier is an adaptation of the DeLaval basic disc-type centrifuge. The separator operates on the principle that oil is lighter than water and solid wastes. Fuel entering the purifier bowl spinning at 4,100 rpm is separated from the water and solids by centrifugal action. The purified fuel leaves the purifier by one effluent direct into the fuel tanks and at the same time water is discharged from a second effluent carrying some solids with it. The remaining solids are retained within the bowl in a solid holding space which has a capacity of over 60 lbs.

Aside from design, the metallurgy involved in the operating parts of the purifier presented problems. Type 316 stainless normally used in the coupling ring, bowl shell and top is generally regarded as sufficiently resistant to sea water corrosion for most purposes. However, type 329 was selected for these parts due to the unusually high centrifugal stress encountered with this large diameter bowl. This stainless steel proved both difficult to forge and machine but provided DeLaval with the one combination required to insure success of the purifier. The forgings were formed in a large closed-die forging press at the Wyman-Gordon-U. S. Air Force plant at North Grafton, Mass. Machining was accomplished at DeLaval.



New DeLaval oil separator can process 12,000 gph of fuel on continuing basis.

Both operations were under navy supervision and inspection, as was final inspection. A design problem overcome was the deft balance required which would permit the bowl and its centrifugal pump to process the required 12,000 gph on a continuing basis with no possibility of error.

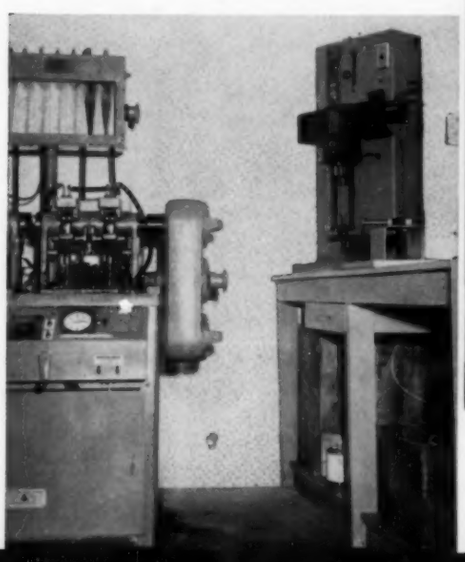
# NEW SHOP FOR INJECTOR REBUILDING

FEW people realize the care and painstaking work which go into the remanufacture of an exchange injector. In order to turn out the very highest quality and precision workmanship on exchange injectors, Stewart & Stevenson established several years ago a complete and separate facility for exchange injector production at the company's San Juan Branch. The facility consists of a separate tile building which is completely air conditioned with filtered inlet and outlet air entrances. To supervise and operate this facility, the company selected one of its most experienced and competent men who has a long background in production rebuild procedures. C. F. Beal, has personally either designed or selected practically all of the new tooling, testing and cleaning facilities.

Exchange injectors are of two different types. The "Deluxe" unit is guaranteed to meet or beat the highest standards of the engine manufacturer. The "Supreme" unit contains all of the premium features of the "Deluxe" injector exchange line plus a greater percent of all new parts. In this plant at San Juan, quality rebuilt injectors are produced at the rate of up to 50 per hour. Of approximately 100,000 units processed through the plant, average rejects have been under one per cent.

Precision gauges, laps and hones aid in assuring quality of exchange injectors. ➧

Two of the calibrating units used in the injector shop. Kent Moore fuel injector comparator is at the right, Bacharach fuel pump test stand at left. ➧



GAS TURBINE PROGRESS

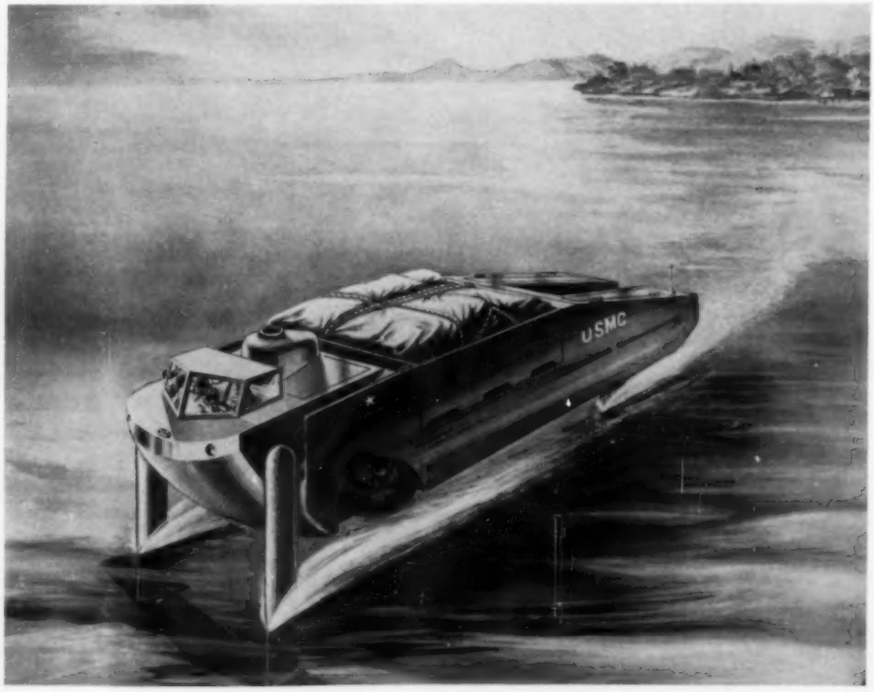
A MONTHLY SUPPLEMENT TO DIESEL AND GAS ENGINE PROGRESS REPORTING ON NEW DEVELOPMENTS AND APPLICATIONS IN THE TURBINE POWER FIELD

# Lycoming Selected By Navy To Develop New Gas Turbine Powered Marine Hydrofoil

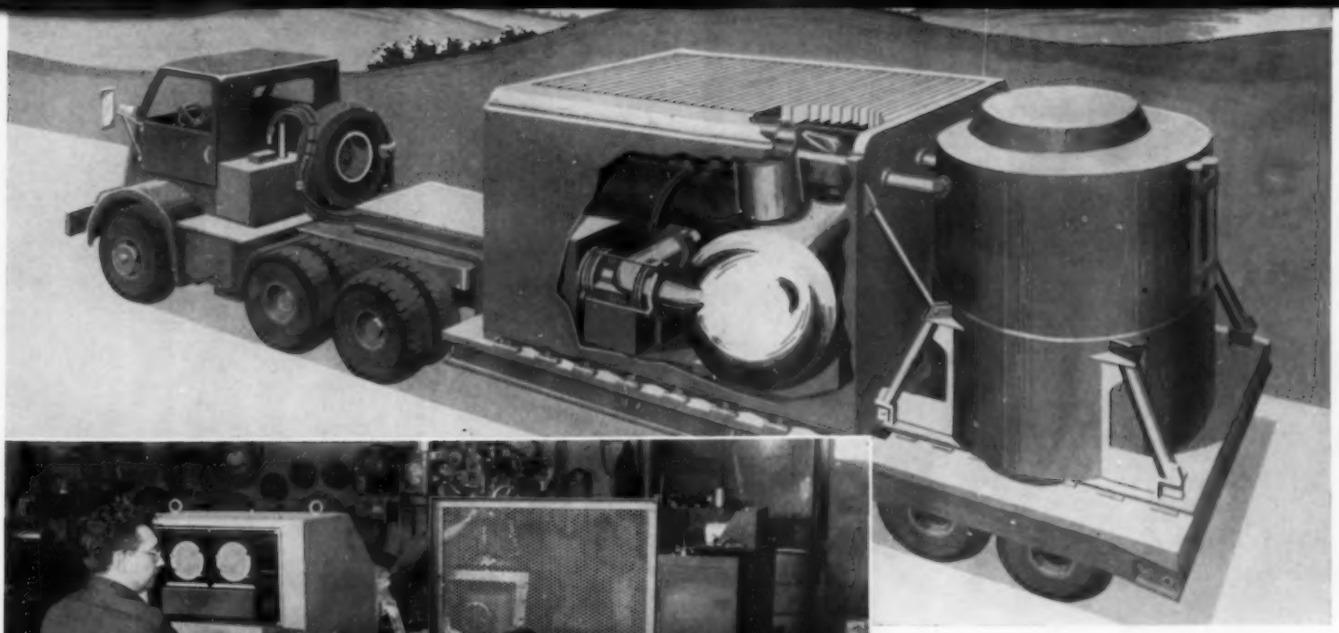
The Navy has selected Avco Corporation's Lycoming Division to design and develop an amphibious landing craft—a gas turbine powered hydrofoil craft with fully submerged foils capable of transporting several thousand pounds at speeds up to 45 knots through rough seas. Known technically as the LVH, or Landing Force Amphibious Support Vehicle, Hydrofoil, this new amphibious vehicle is designed to be used by the Marine Corps in a logistic role during landings. Specifically its mission is designed to transport cargo during the assault phase of an amphibious operation from widely scattered LST's, LSD's and LPD's offshore. It must be capable of "flying" through rough water, boating through the surf zone and traversing difficult beaches, sand dunes and other rough terrain normally encountered in off-road operation, reach an unloading point and then return to ship.

"Flying" speed in excess of 55 knots, boating speed of several knots and overland speed of more than 25 miles an hour is made possible through the use of the new Lycoming TF-1430 marine gas turbine engine which can operate on a variety of fuels. All dimensions were designed so as to allow operations from virtually any Navy ship. Avco's Lycoming Division, known for production of aircraft engines and missile components, has also had considerable experience in hydrofoil activity through the past several years. In 1959, for the Army, it designed and developed the "Flying Duck", a gas turbine powered hydrofoil conversion of the famed World War II DUKW which proved conclusively the principle of the turbine-hydrofoil marriage. Prior to that it installed a Lycoming T53 in the "Halobates", a modified LCVP, developed by the Navy.

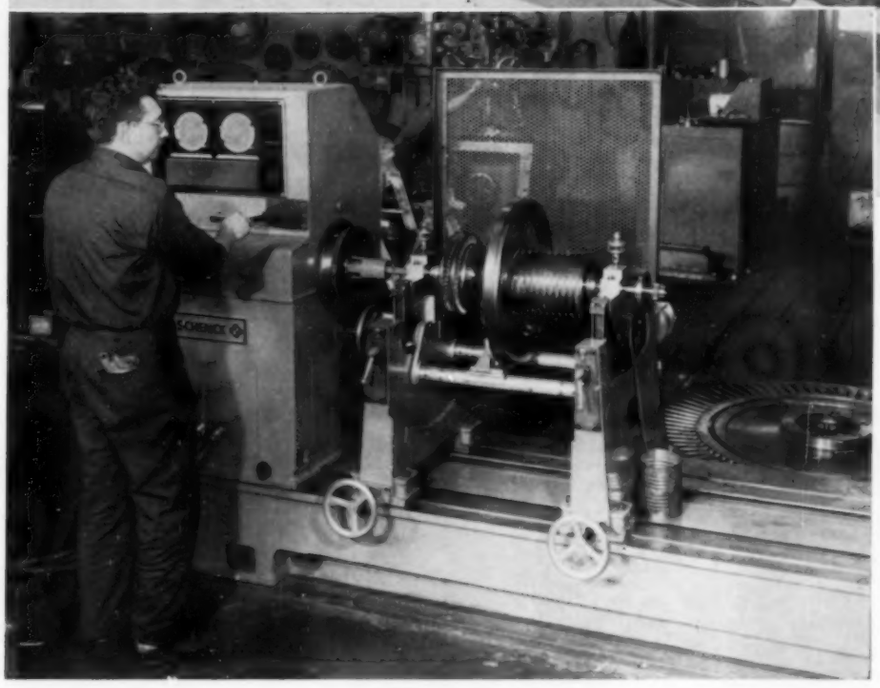
In order to meet all design requirements stipulated by the Navy for the new vehicle, Lycoming engineers incorporated several unique features into the LVH. The hydrofoils, one forward and one aft, are of high aspect ratio design and are completely submerged during all water operation. For land travel, they are retracted entirely within the confines of the hull. The foils are self cleaning and have been structually designed to operate through floating debris without damage. Separate propellers are included for boating and "flying" operations. The "flying" propeller is mounted on the forward portion of the bottom of the rear strut. The entire lower section of the strut, including the foil and propeller, is rotatable to provide dynamic steering. The boating propeller is separately mounted on a retractable drive beneath the hull. The four huge 18:00 x 25:00, 12 ply tubeless, self sealing tires are mounted on fully retractable wheels for boating and "flying" operations. Power steering of the front wheels is provided. Terms of the contract call for delivery of the first of the new craft in January 1963. Initial qualification tests will be performed in Long Island Sound off Stratford. Government test and evaluations will be conducted at the Marines' Camp Pendleton in California.




**Navy's newest amphibious landing craft, the gas turbine powered LVH, is depicted in an artist's sketch performing as a weapons and cargo carrier during an assault operation. Designed by Avco Corporation's Lycoming Division, the LVH will be capable of "flying" at speeds up to 45 knots or travelling overland at speeds of more than 25 mph.**



Artist's conception of ML-1 mobile nuclear power plant mounted on a trailer. Unit is designed to operate 10,000 hrs. without refueling or overhaul.



Dynamic and static tests are conducted on Clark turbine-compressor rotor which will be part of closed cycle, gas cooled reactor turbogenerating system.

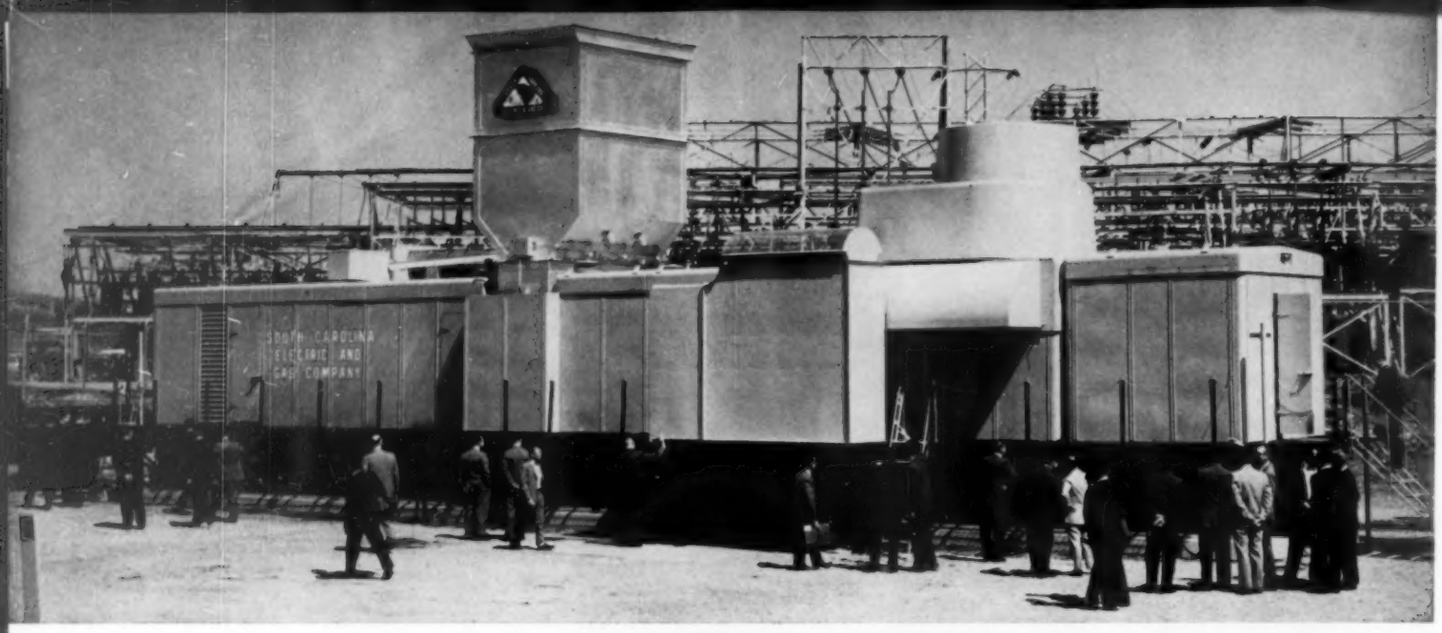
Closed cycle gas turbine designed by Clark Bros. for use in mobile nuclear power generating plant.

# TURBINE-COMPRESSOR FOR NUCLEAR-ELECTRIC UNIT

A NEW turbine-compressor scheduled for use in the world's first mobile nuclear-electric power plant has reached the testing stage. Over a year in development by Clark Bros. Co., the turbine will be incorporated into a compact, power conversion skid which may then be operated in conjunction with the Army ML-1 portable reactor skid, as a closed cycle, gas cooled reactor turbogenerating system. The turbine may also be incorporated with a fossil fueled, closed-cycle heater to develop data on the operational characteristics of the closed cycle gas turbine systems. Aerojet General Corp. is developing the ML-1 under contracts with the U. S. Army Corps of Engineers and the Atomic Energy Commission.

Designed to generate 330 kw, this prototype power plant will be capable of transport by truck, air, rail, barge or sled. It will be operational in any climate and any location, will deliver rated output at ambient temperatures from 100° F to -65° F and can operate 10,000 hrs. without refueling or overhaul.

The concept of a mobile nuclear power plant involves the use of nitrogen in a pressurized closed cycle system. The nitrogen is introduced to the compressor at approximately 8 atmospheres, compressed to 20 atmospheres, passed through a recuperator where it picks up heat from the turbine exhaust and finally through the nuclear reactor which raises the temperature to 1200° F. As the hot nitrogen expands in the turbine, it provides energy to drive the compressor and the generator. The Clark turbine is a single shaft, axial flow type built to operate at 22,000 rpm. Light metals are used for static parts not subjected to severe temperatures. The Clark compressor is also a high efficiency, axial flow type. The set can also operate with air under emergency conditions.



# CAROLINA UTILITY INSTALLS 11,250 KW PACKAGED TURBINE PLANT

## New General Electric Peaking Unit is First of Four Ordered by South Carolina Electric & Gas; Plant Installs for $85/KW and Goes on Line in 10 Minutes

DURING the last several years there has been a notable move by the electric utility companies to install peaking power particularly in the form of diesels and gas turbines. This move and the resulting economies that can be achieved in system design and operation have been well confirmed in various studies, and impetus has been added by the development of truly low cost types of generation capable of rapid start and load change which are ideally suited to peaking service. Among the manufacturers of these packaged power units is General Electric Co. and its newest gas turbine plant rated at 11,250 kw has just been installed by the South Carolina Electric and Gas Co. at Burton near the southern extremity of the Company's service area. In total, SCE&G purchased four of the 11,250 kw units. The second will be installed this year at Charleston and the third and fourth at these locations during the summer of 1963.

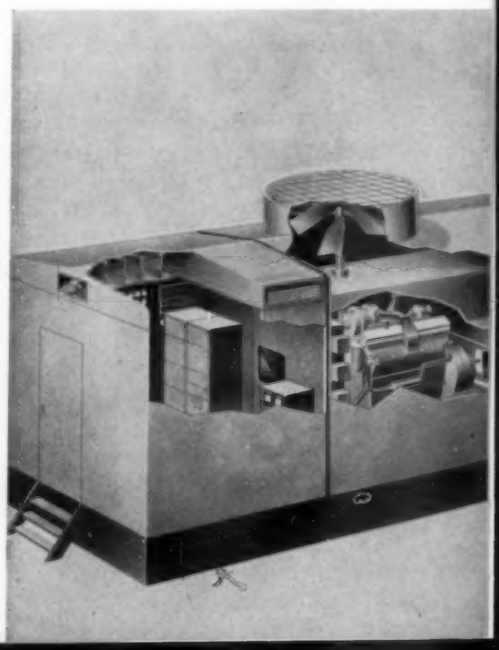
The new power package, demonstrated at the Company's Schenectady Works prior to shipment to SCE&G, was designed to provide a low-cost, remote-controlled, unattended power source and according to G-E officials can be installed at $85 per kilowatt. Rated 11,250 kw for peak service at NEMA conditions—80° F and 1000 ft. altitude, the package's overall dimensions are approximately 80 ft. long, 22 ft. wide, and 16 ft. high. It can be shipped by rail in four major components, installed and normally placed in service in about 10 days. During test in Schenectady, it took under 10 minutes to attain full load, synchronize and go on the line.

One of the features of the package concept General Electric believes is that less than 5 per cent of the total cost of the station will be expended for the site and for labor and materials at the site. As the center of load demand changes, the entire station can be moved by conventional carriers to another location. Less than 5 per cent of the initial investment would be left behind, and the value of the property could be subtracted from this. The plant itself is completely self-cooled and its acoustic treatment permits operation in a suburban area environment.

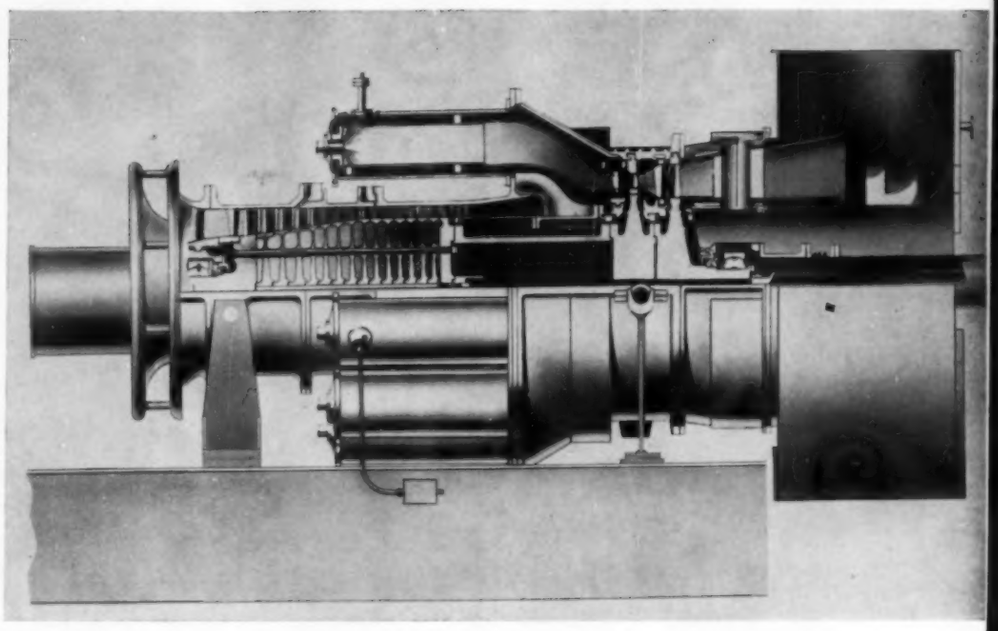
The package is mounted on a simple foundation. Two "I" beams running the full length of the foundation act as rails to facilitate moving the units into position during erection. A simpler foundation can be used where a crane is available. The units can be started without external auxiliary power thereby providing maximum system protection during emergency service conditions. Adequate facilities and accessibility for maintenance at the site include protection for personnel during prolonged maintenance periods. The design permits operation at ambient temperatures from—40 to + 120° F and when blocks of power of more than 11,000 kw are required, multiple units can be installed.

### Power Unit

The power unit is the largest and heaviest component. It consists of two assemblies bolted together for shipment, one housing all control panels; the second, the turbine with all accessories and auxiliaries. Overall length of the power unit is 42 ft. Control compartment is about 10 ft. long and can be detached from the turbine base to facilitate shipment when necessary. Structural steel framework supports the fabricated steel roof sections to provide housing or lagging for both power unit and generator. Roof sections are easily removed to permit access with station crane to all components. Side panels minimize sound radiation—panels are hinged where frequent access is desirable. Raising of supporting panels provides



Here is the new G-E 11,250 kw package turbine plant on test at Schenectady, N.Y., prior to shipment to South Carolina Electric & Gas Co. Overall unit is 80 ft. long.

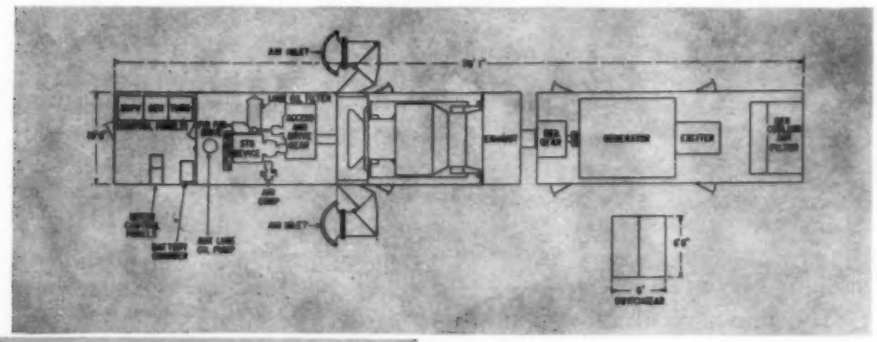


Cutaway of the General Electric single stage gas turbine with axial flow compressor. A two-bearing machine, load is connected at the exhaust end of the unit. Turbine and compressor casings are horizontally split for accessibility and maintenance.

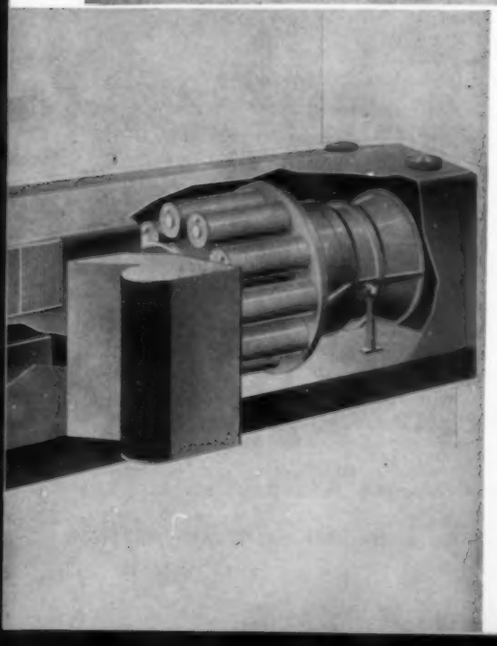
roof 24 ft. wide to provide overhead protection for maintenance personnel in these areas.

The power unit is divided into four compartments. The control compartment is separated from the turbine accessory compartment by a 4 in. gap between bulkheads, with entry provided by twin doors in the two bulkheads. This effectively isolates the control area from the machinery area. In the control cab of the first South Carolina Electric & Gas Co. unit are modified dual switchboards to control the turbine and generator and, for this unit, an optional remote supervisor station with APRIL (automatic program remote indicating logging equipment). Operation of the package power plant will be handled from inside the control cab or over microwaves from the master station in Columbia, S. C., through the remote station of the package. Among other things, APRIL equipment transmits gas usage and kilowatt hours back to the master station. At a glance, the operator can tell total input (gas usage) and total output (kilowatt hours.)

Space beneath the floor of the control compartment contains the station 125-volt battery and battery charger. Roof of the compartment houses a distillate fuel tank providing a fuel supply for the diesel starting engine, and an emergency fuel supply for the turbine to permit operating during temporary failures in the normal fuel supply. A



Plan view of the 11,250 kw power package—note building block technique.



Power compartment showing control room, Cummins turbocharged 505 hp starting diesel, accessory gear box and G-E gas turbine.

compartment blower in the roof section supplies filtered pressurization and ventilating air for the electrical equipment.

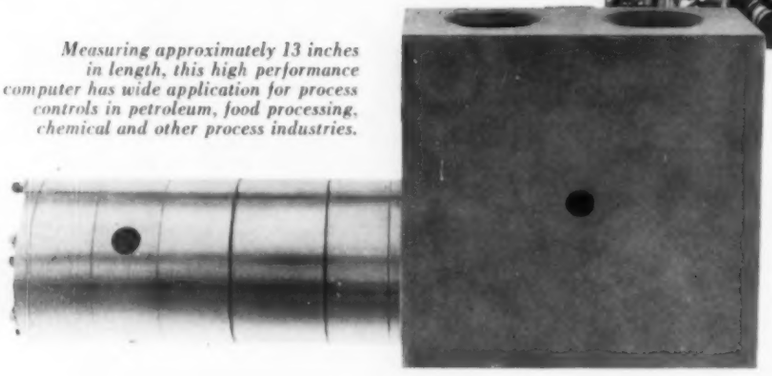
The diesel starting engine as well as all other plant auxiliary equipment is housed in the second compartment. Major auxiliaries such as the lube pump, fuel regulator, speed sensing device, circulating water pump, and radiator fan are mechanically driven off the accessory gear box which is built by G-E at its Lynn plant. Two systems are worth mention—first is the closed loop lube oil cooling system which works in conjunction with a Hilliard F39X full flow filter. Water in constant circulation absorbs heat from the lube oil coolers and rejects heat in extended radiator surface to ambient air induced by the radiator fan. Thus raw water supply for lube cooling is not required. Second system concerns plant startup in which a Cummins V-type diesel rated 505 hp at 2200 rpm is installed using compressed air start. The diesel drives the gear pack with a ratio of 1.1:1 to provide maximum starting turbine speed of 2450 rpm. Third compartment houses turbine compressor air inlet.

Next compartment houses turbine power—a single cycle, single-shaft unit with axial flow compressor. Provisions are made to facilitate access at turbine inspection points, such as the turbine combustion area where standard doors are provided on both sides of the housing. Ventilation is provided in this compartment by eductors located at the aft end of the housing near the exhaust.

Base and housing construction of the generator unit are similar to the power unit. The generator unit contains the vertical offset 1.85:1 gear which reduces the turbine operating speed of 4860 rpm to the 3600 rpm generator speed; two pole, open-ventilated generator, a 50 kw direct connected exciter; field breaker and resistor cabinet and generator cooling air filter with open ventilated units. Armature connections are provided on either side of the unit and located in such a way to permit connection on the metal-clad switchgear.

With the building block approach, G-E's Gas Turbine Department engineers have given the new power package the flexibility required to meet individual customer requirements. Indicative of this are recent orders for six additional units for utility and gas transmission service.

# AiResearch introduces pneumatic computer to the process industry



*Measuring approximately 13 inches in length, this high performance computer has wide application for process controls in petroleum, food processing, chemical and other process industries.*

***The AiResearch Pneumatic Analog Computer (APAC)*** is the next evolutionary step in process control. It assures continuous on-line solution within one percent overall accuracy of expressions or equations requiring as many as 10 or more mathematical functions.

AiResearch can (a) mechanize your control expressions, (b) assist you in formulating the control expressions and mechanize them, or (c) present you with a packaged system.

This industrial computer system is a result of more than 20 years of experience by AiResearch in the design and manufacture of pneumatic, hydraulic and electronic control systems and components.

***Provides control accuracy within 1%***

- ***Performs all necessary mathematical functions***
- ***Utilizes existing plant instrumentation***
- ***Can receive and transmit electrical signals***
- ***Comparative low costs assure rapid pay-out***
- ***The building block technique of modular construction assures flexibility to cope with problem changes.***

*• Please direct inquiries to Controls Systems, AiResearch Phoenix Division*

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

*Los Angeles 45, California • Phoenix, Arizona*

*Systems and Components for:* AIRCRAFT, MISSILE, SPACECRAFT, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS

### General Sales Manager

J. J. Wall

Electric Machinery Mfg. Co., Minneapolis, Minn. has named James J. Wall Jr. to the post of general sales manager. He succeeds the late H. W. Forschner. Mr. Wall joined E-M as a salesman in the New York territory in 1951. From 1954-1956 he was Cleveland district manager. In 1956 he became New York district manager. He leaves the latter post for his new assignment.

### Ohio Crankshaft V.P.

R. S. Sheetz

Election of Richard S. Sheetz as executive vice president of The Ohio Crankshaft Co., Cleveland, has been announced. Mr. Sheetz, 38, has been manager of Westinghouse Electric Corp.'s Springfield, Mass. plant and previously has held management positions in Westinghouse operations in Bloomfield, New Jersey and Mansfield, Ohio. Ohio Crankshaft is a producer of crankshafts and camshafts for heavy-duty engines as well as Tocco induction heating equipment.

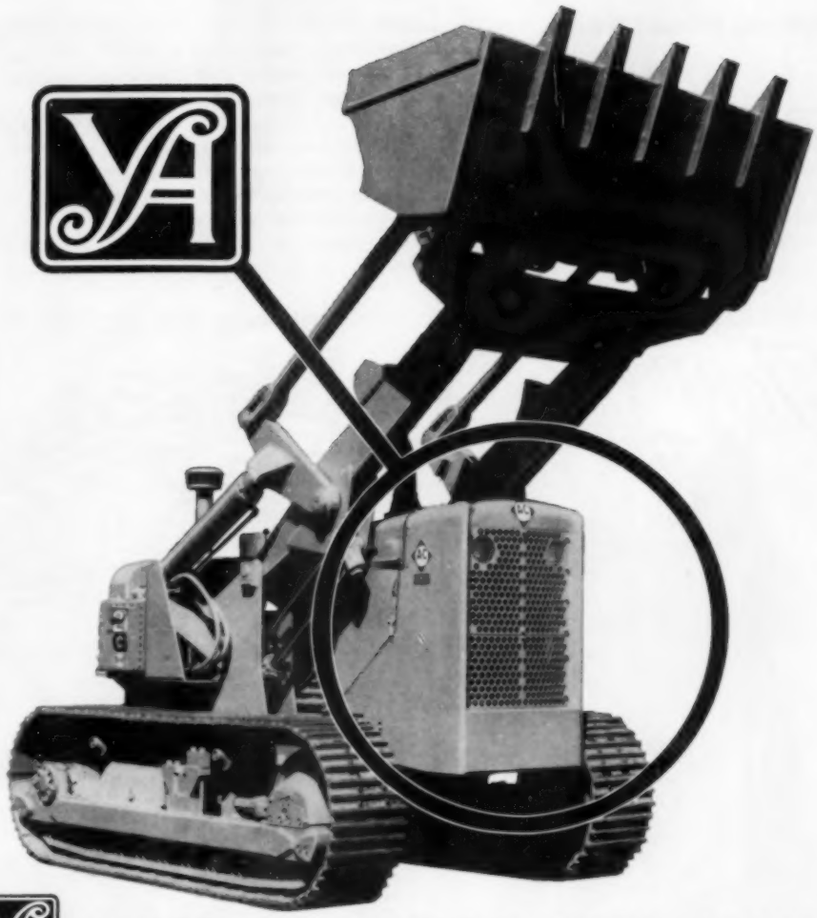
### Three New Axle Series

With three new series of trailer axles added to its TK series, Rockwell-Standard Corp. now offers a complete family of "Related Design" trailer axles, according to information from the corporation. These three new series, known as the TH, the TR and the TU series, added to the TK series provides a capacity range from 14,000 lbs. to 30,000 lbs. The new TH series of 14,000 lbs. capacity will accommodate both single and dual wheel applications. Light in weight yet rugged in construction, it permits maximum payloads for the efficient operation of such trailer types as vans, low beds, auto haulaway units and other wide-track applications, according to Rockwell engineers. The TK series of axles provides for capacities up to 20,000 lbs. The new TR series offering maximum payload, provides for loads up to 22,500 lbs. capacity, while the new TU series, the "Big Brother" of the Rockwell-Standard family of trailer axles, is capable of handling 30,000 lb. capacity loads. A twelve page descriptive folder on this line of trailer axles may be obtained by writing Rockwell-Standard Corp., Transmission & Axle Division, Detroit 32, Mich. (ITS NEW)


SAVE MONEY WITH Interstate

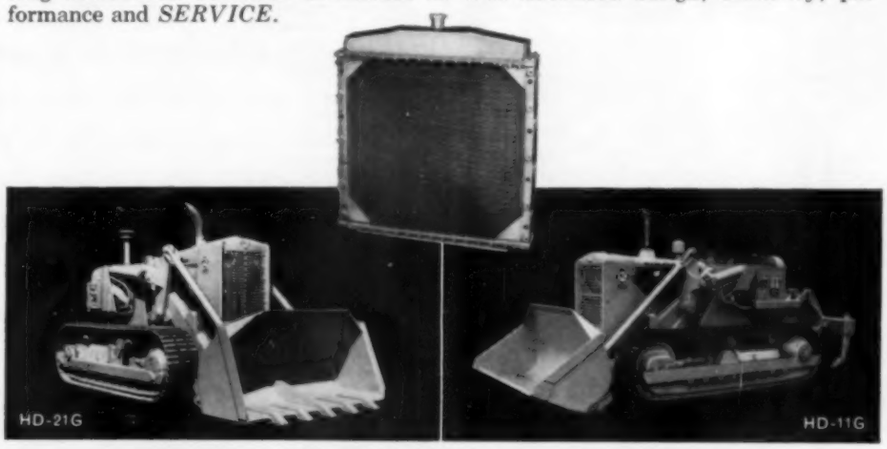
diesel service incorporated
2093 East 19th St., Cleveland 15, Ohio
America's largest GM fuel injector rebuilder





YATES RADIATORS COOL ALLIS-CHALMERS HD-11G HD-21G TRACTOR SHOVELS

Keeping the diesel engines properly cooled is extremely important in meeting the tough, modern job requirements for construction equipment. The use of Yates radiators on A-C HD-11G and HD-21G Tractor Shovels is another example of the long established customer confidence in Y-A advanced design, efficiency, performance and *SERVICE*.




WRITE OR CALL NOW FOR COMPLETE INFORMATION

*Symbol of Service*

HEAT TRANSFER DIVISION
YATES-AMERICAN
703 4th STREET, BELOIT, WISCONSIN

## Mid-West Diesel News

*By* L. H. Houck

NEW boat for the Lake of the Ozarks vacation region—the *MV Commander*. Built by Dubuque Boat & Boiler Co., Dubuque, Iowa, for S. R. Palmer, it has two 6-71 GM diesels. The excursion boat weighting 78 tons, was moved by truck for 40 miles from near Jefferson City. Belger Cartage Co., Kansas City, heavy movers, had the overland contract and tow truck was a Mack diesel.

JUST installed, a 15 kw Kohler gas-electric set to provide additional emergency electricity for Whiteman AFB hospital, Knobnoster, Mo. Installation by Bachman Electric Const. Co., Kansas City. Sale by Kohler distributor, AAA Engine & Electric, Inc., Kansas City, Kansas.

PORTABLE sub-station for Southwest Electric Cooperative, Bolivar, Mo., with two Cummins 380 hp diesels, from Cummins, Kansas City.

NORTH Kansas City Hospital has taken delivery on a 300 kw standby unit which uses a V-12 Cummins diesel. Sale by Cummins, Kansas City.

EARLY diesel locomotive has been presented to the Museum of Transportation, St. Louis by Southern Railway System. The locomotive, forerunner of modern diesel-electric engines, is a 1350 hp "A" unit GM freight demonstrator which in 1940 traveled 83,764 miles on railroads in 35 states to show its capabilities. It is No. 6100 SP.

PALMER Crushing Co., Colgate, Wis., has repowered a 175A Michigan loader with a 4-71 GM diesel installed by Inland GM Diesel, Inc., for Aring Equipment Co., both of Milwaukee.

INLAND GM. Diesel, Inc., Milwaukee, has installed a new 6V-53, delivering 185 hp at 2500 rpm in a Ford T850 tandem dump truck for Jefferson County Highway Department.

MARION model 35 M backhoe with Cummins J6BI diesel to John Zehrer Construction Co., St. Louis county, from Ryan Equipment Co., 3350 Morganford Road, St. Louis.

ALLIS-Chalmers model DD motor grader with A-C D-262 diesel to Bonne Terre Farming & Cattle Co., Bonne Terre, Mo. Sale by Ryan Equipment Co., Allis-Chalmers dealers, St. Louis.

TWO 15-ton Cline trucks with GM 4-71 diesels to Mico Mining Co., Clayton, Mo., from Ryan Equipment Co., St. Louis.

BAKER Quarry, Valley Falls, Kansas, has repowered a Unit crane with a C105 Cummins diesel from Cummins, Kansas City.

CLINT Thompson, contractor, Osage City, Kan., has repowered a 5 ton Ford F800 dump truck with a C180 Cummins diesel from Cummins, Kansas City.

CLARENCE Hayden, Opolis, Mo., has installed a Cummins diesel in a Minneapolis-Moline farm tractor. Engine from Cummins, Kansas City.

YELLOW Transit, Kansas City, has purchased 240 White tractors, (9064 TD) with Cummins NH-220 diesels, equipped with Luberfiner oil filters, Perry water filters.

THREE Ferguson model SP120 self-propelled tamping rollers with GM 4-71 diesels to R. B. Potashnick Construction Co., Cape Girardeau, Mo., from Ryan Equipment Co., St. Louis.

ALLIS-Chalmers model HD11G tractor shovel with Allis-Chalmers D-516 diesel to Fred Weber Contracting Co., St.

Alnor double target Pyrotroller

Motorized switch with modified circuitry

# Alnor Diesel Malfunction Alarm

## *or Load Balance Monitoring System*

Furnishes a continuous automatic check-up on the operating efficiency of diesel engines. Like an expert supervisor watching every minute for trouble in any individual cylinder.

***Here's how it works—***

This system incorporates a special motorized switch with modified circuitry and a temperature differential, double target Pyrotroller with a scale range of 300° F. below to 300° above the existing average temperature.

Working together, these components provide the following action. The motorized switch automatically and continuously scans each individual cylinder. The load balancing Pyrotroller then relates each cylinder temperature to the automatically computed average of all the other cylinders. An alarm is sounded when, and only when, an individual cylinder exceeds or falls short of the computed average by whatever predetermined value has been set. This setting can be done conveniently on the front of the instrument.

It does this completely automatically, average computation and all, in a scant five seconds per cylinder.

(Note: With the adoption of double element thermocouples in a single stem (same stem size), and the addition of a standard pyrometer, this system will also indicate the exact temperature of each cylinder.)

What does this mean to the user? It means plenty of diesel engine operating advantages no other single system can possibly provide.

1 It provides constant scanning, freeing an operator for other services.

2 It provides automatic average engine temperature computation.

3 It takes into consideration the general engine load condition.

4 It furnishes a much more precise indication of cylinder irregularity.

5 It detects and "points its finger" at the specific overloaded or malfunctioning cylinder.

6 It provides this complete automatic monitoring in much less time than required by any other semi-automatic or manual method.

Yes, the exclusive new Alnor Load Balance Monitoring System is control—automatic control—in the truest sense of the word, and a timely example of Alnor's engineering and knowledge of diesel engine control.

This system permits a minimum of personal supervision and is particularly valuable in electric generating stations and gas pipe line compressor stations or any installation where continuous peak efficiency is required.

Alnor INSTRUMENTS

**ALNOR INSTRUMENT CO.**

*Division of* Illinois Testing Laboratories, Inc.

Room 508 • 420 North La Salle Street • Chicago 10, Illinois

Louis, from Ryan Equipment Co., St. Louis.

UNION Asphalt Co., Kansas City, has repowered a White with a Cummins NH-195 from Cummins, Kansas City.

NATIONAL Utilities Co., Milwaukee, has taken delivery from Inland Diesel, Inc., a 6-71 GM power unit. Unit drives a LeRoi compressor and is used in rotary drilling.

CENTRAL Wisconsin Motor Transport is operating 15 new International Harvester model DC-405 trucks with GM-6-71 E diesels.

ALLIS-Chalmers model HD11B tractor with A-C D-516 diesel to County of Jefferson, Mo., from Ryan Equipment Co., St. Louis.

## Gulf Coast Diesel Notes

*By* Elton Sterrett

FATJO Drilling Co., Lafayette, La., has placed an order with Waukesha Sales & Service, Inc., of Houston, for the complete power equipment for an aquatic drilling rig, barge mounted. The diesels include two 60 kw ac generating sets, each driven by a model 148 DKU Waukesha diesel; a similar unit for standby power, and a fourth 148 DKU driving a model KPE5 Gardner-Denver pump; two model 180 DLCU diesels, one driving an air compressor, the other a water pump; two model WAKDU's; one NKDU; 1 LRDC; all to be mounted on a barge to be supplied by the Waukesha Houston organization.

EMPIRE Geophysical Services, Fort Worth, Tex., has obtained from Pearce Equipment Co., Houston, through its supplier, Geophysical Equipment Manufacturing Co., Houston, two Perkins diesels. One, a model 204, will drive a hydraulic pump, the other a model 340, will power a special truck being delivered to the Empire Company for exploration work.

### Indicating Control Sheet

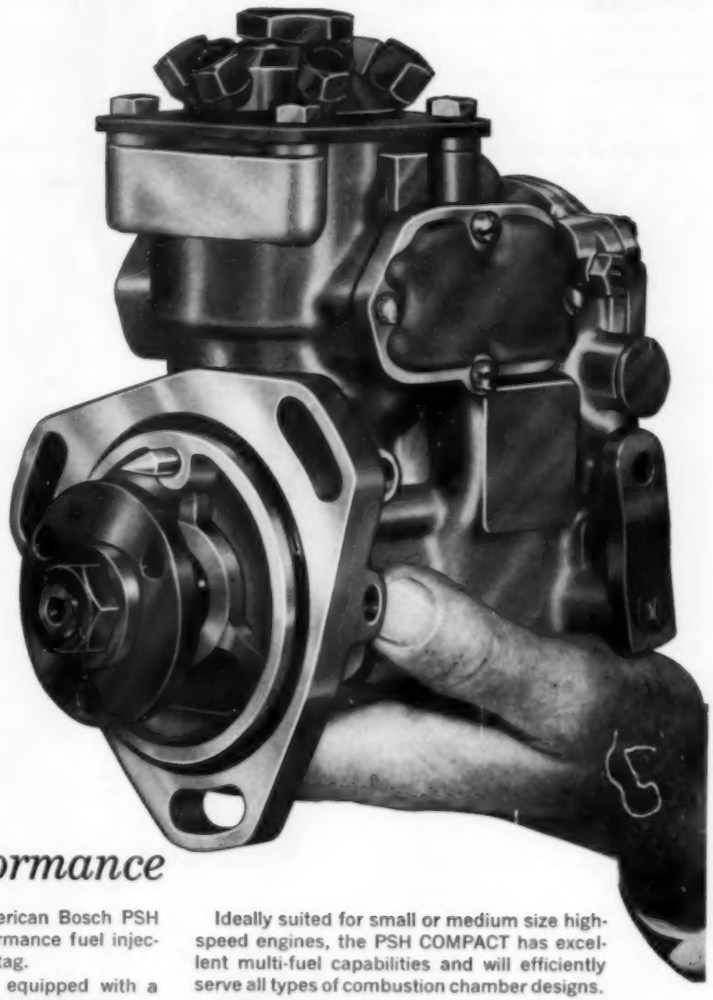
United Electric Controls Co., has released a new design catalog sheet on the Type E36N, indicating temperature control. New high temperature (0 to 1000°F) indicating control (series 900) plus low cost compact short range indicating temperature control (series 800) are both featured on a single detailed specification sheet. Applications, construction features and control ranges are fully described. For a copy write L. E. Pratt, United Electric Controls Co., 85 School St., Watertown 72, Mass. (ITS NEW)

### Industrial Converters

A new two color, four page folder, Form C270, describing new 12- and 13-inch wheel C270 series industrial torque converters, is available from Automotive Division, Clark Equipment Co., Buchanan, Mich. The units, intended for such applications as heavy duty lift trucks, loaders, crawler tractors, wheel tractors and other vehicle and stationary power transmission, have input horsepower capacities up to 125 hp. The torque input of the 12 in. wheel is rated at 200 lb./ft. and the 13 in. wheel at 270 lb./ft. Specifications in the folder include a cutaway section of the torque converters, dimensioned interior and exterior drawings and a selection chart of input horsepower and rated rpm. (ITS NEW)

**AVAILABLE NOW!** The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG**, Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG**, 10850 Riverside Dr., North Hollywood, Calif.

***Great new things are coming from AMERICAN BOSCH!***



**NEW COMPACT DESIGN**

*top pump performance*

You're looking at the American Bosch PSH COMPACT—the HIGH performance fuel injection pump with a LOW price tag.

Here's a compact pump, equipped with a governor and supply pump, that is simple in design, light in weight, with fewer parts . . . yet, the PSH COMPACT retains the proved features and superior injection characteristics of other American Bosch distributor-type pumps.

Ideally suited for small or medium size high-speed engines, the PSH COMPACT has excellent multi-fuel capabilities and will efficiently serve all types of combustion chamber designs.

If you want top performance and dependability in fuel injection, in an economical price range, it will pay you to specify the American Bosch PSH COMPACT. It's today's big value in fuel injection. Ask for complete details.

MOVE AHEAD

***AMERICAN BOSCH ARMA CORPORATION***

***Commercial Sales Division • Springfield, Massachusetts***

**Diesel Fuel Injection Systems**

**Ensign Carburetion**

**Hydraulic Cranking Systems and Accumulators**

**Automotive Electrical Equipment**

**Magnetos and Ignition Equipment**

## Compressor Engine Course

A short course on Gas Compressor Engines will be held at the University of Oklahoma, Norman, on October 5th and 6th. Sessions in the two day course will include coverage of hydraulic governors, engine analyzers, porous chrome liners, combustion fundamentals, detonation, lubricants, filtration, scavenging and ignition. Registration for the course is open to all interested persons, particularly supervisors, maintenance and operating personnel. A folder outlining registration procedure and topics is available from M. L. Powers, director, Business and Industrial Services at the University.

## Peaking Set for Hawaii

The first diesel peaking generating set for use in the Hawaiian Islands is being built by Fairbanks, Morse & Co. at Beloit, Wis., for Hilo Electric Light Co., Ltd. It will deliver 2000 kw within 90 seconds from a cold start. Hilo Electric, a utility serving the entire Island of Hawaii, purchased the generating set to take care of its peak demands. The entire assembly can be moved from place to place as power demands change. This is because all switchgear and control equipment is housed in a separate waterproof cubicle, which is skid-mounted as is the 12 cylinder engine. Switchgear and engine control equipment is arranged for automatic start and stop upon power failure or predetermined voltage drop. When initially installed, the set will be controlled manually, from a remote station on the feeder lines. The set will be located at Naalehu, Hawaii, 65 miles from Hilo Electric's main plant. The Hilo engine has some special features designed to meet Hawaiian needs: a weatherproof housing that encloses the entire set, and heaters to keep the equipment dry in the humid climate. It has radiator cooling and is completely self-contained with air start equipment (including air start tank), generator and exciter, heat exchanger, lube oil cooler, exhaust silencer and air filter.

## Engine Sales Representative

Appointment of Tom Young as a special Engine Division Sales Representative in the state of Louisiana, with headquarters in the New Orleans office, was recently announced by Nordberg Mfg. Co. Mr. Young will assist in the application and sale of Nordberg diesel engines to the municipal and marine markets.

## Torque Converter Brochure

A new bulletin just issued by The Eimco Corp. explains why a torque converter is standard equipment in the Eimco tractor power train. This 24-page book outlines through pictures, graphs, cartoons and sketches just what is torque and how a torque converter works; the advantages of a single-stage torque converter, such as is standard on every Eimco, versus multi-stage torque converters. A copy is available by writing for Bulletin L-1078 to The Eimco Corp., P. O. Box 300, Salt Lake City 10, Utah. ITS NEW

## Engine-Compressor Bulletin

The White Diesel Engine Division of The White Motor Co. has issued a four-page bulletin on their line of balanced-opposed engine-compressor units for continuous, heavy duty service. The literature summarizes the features of the two, four, and six-cylinder models, such as matched design of the two components the 200 to 1000 bhp range of Superior engine power, and the flexibility provided by 68 standard cylinder sizes. Construction details are also summarized in capsule form, with appropriate illustrations, and both dimension and specification tables are shown. Copies of Bulletin 989 are available from, White Diesel Engine Div., Springfield, O. ITS NEW


GN

Pedrick

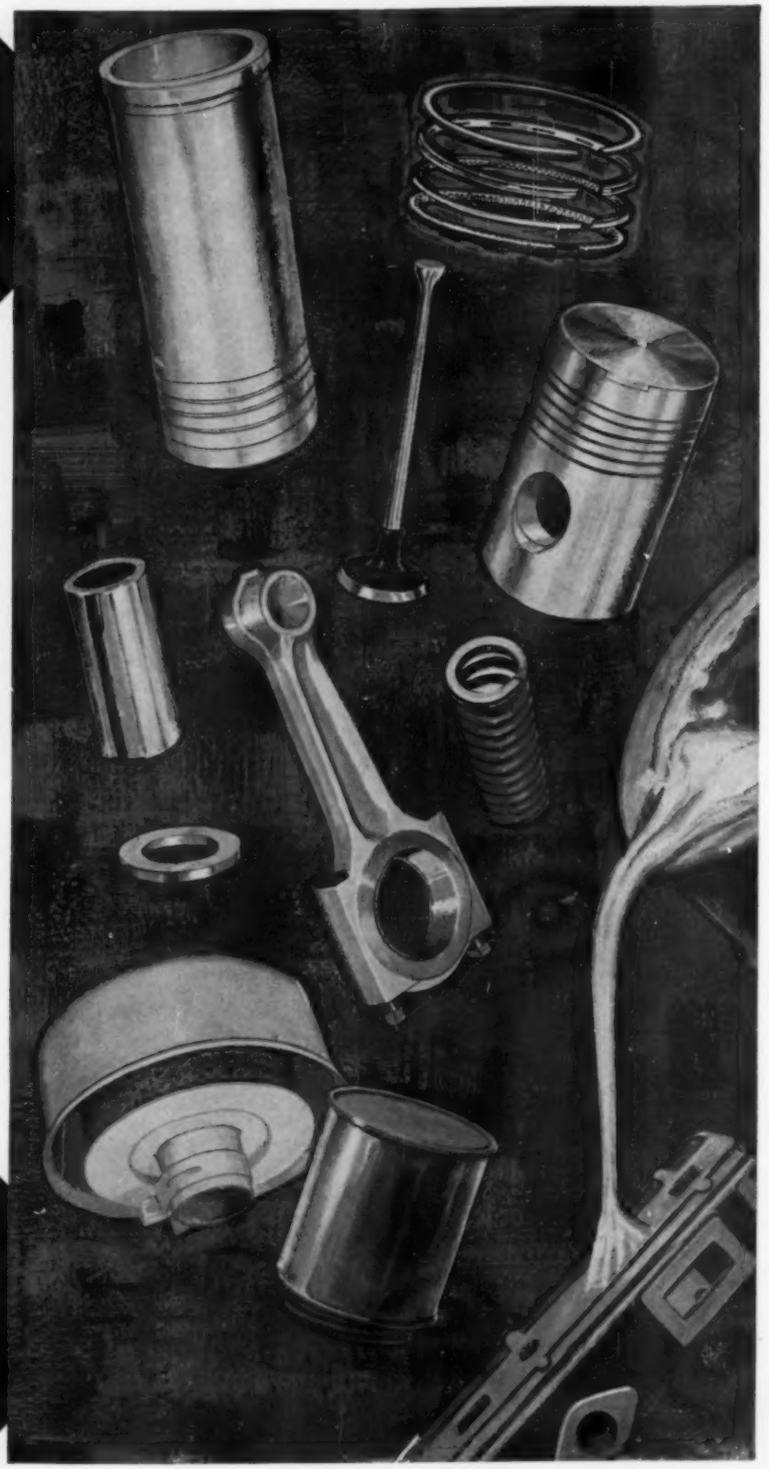
SUPERIOR

WHITE
MACHINE WORKS

BURD

GE

GN



### Regional Manager

John Olson, since April, 1960, manager of the Chicago sales office of the former Rochester Manufacturing Co., I. , now part of the American-Standard Controls Division, has been assigned responsibility for regional sales of its line of industrial controls, according to an announcement by J. R. Warnock, vice president—marketing. Prior to joining the Rochester organization, Olson was sales manager for the H. C. Christians Company, Chicago.

### Solar Dayton Manager

Leon H. Fish has been appointed manager of Solar Aircraft Co.'s Dayton, Ohio, branch office. Fish will be in charge of Solar military relations activities at Air Force installations in the Dayton area, including Wright-Patterson Air Force Base, and Strategic Air Command headquarters in Omaha, Neb. Prior to rejoining Solar, he was an executive of Acme Precision Products and subsequently became associated with Carlson and Associates of Dayton, manufacturer's representatives.


*Nation's largest manufacturer of heavy-duty and specialized engine parts—*

# NEW GOULD-NATIONAL ENGINE PARTS DIVISION

In creating its new Engine Parts Division, Gould-National combined under one corporate roof the brands, products, services and facilities of these wholly-owned subsidiaries:

**Wilkening Manufacturing Co., Philadelphia,** manufacturers of Pedrick® piston rings and castings.

**White Machine Works, Eau Claire, Wisconsin,** manufacturers of Superior-Arrowhead cylinder sleeves, sleeve assemblies, pistons, piston pins, Burd piston rings, valves and valve train parts, foreign car engine parts and filters.

**Gillett & Eaton, Lake City, Minnesota,** piston and casting specialists of cast iron, aluminum alloy, Vanasil® aluminum alloy pistons and specialized engine parts.

**Arrow Head Steel Products, Howell, Michigan,** manufacturers of aluminum pistons, connecting rods and other castings.

Now, Gould-National, the nation's largest producer of automotive replacement batteries, is also the nation's largest basic manufacturer of heavy-duty and specialized engine parts. The Division is the largest one stop source for the most complete line of engine parts available from one manufacturer. It is the only engine parts manufacturer with both iron and aluminum casting and machining facilities.

By utilizing the efforts of one combined sales force, the customer will benefit from greater sales-service efficiency, more concentrated field coverage.

Product improvement will result from the formation of a special team in the Gould-National Engineering and Research staff. It is the Gould-National way of assuring continuing top quality and improved product performance.

New engineering developments, manufacturing and production techniques from all areas within the Division will benefit all customers, no matter what the product may be.

This is the Gould-National Engine Parts Division—the nation's newest parts manufacturing group with over two centuries of combined experience.

Need heavy-duty engine parts? Automotive engine parts? Foreign car engine parts? Parts for such specialized applications as air and refrigeration compressors? Need complete and modern facilities for aluminum and iron castings? If your specifications call for the best of these, if you need them fast and need them right . . . turn to . . .

Superior-Arrowhead and Burd are trademarks of Gould-National Batteries, Inc.

GN ENGINE PARTS DIVISION
**GOULD-NATIONAL** BATTERIES, INC.
St. Paul 1, Minnesota


### Lease System Meeting

How to do an increasingly economical job of relieving truck users from worrying about truck procurement and maintenance, will receive major attention at the seventeenth annual meeting of the National Truck Leasing System, convening in Chicago at the Edgewater Beach Hotel, October 1-5. The system is a nationwide network of independently owned, locally controlled truck lessors. The accellerated demand for this type of facilities during the past few years, has resulted in the establishment of a number of new concerns prepared to provide full-service truckleasing. Reports Frank Max, Jr., president of National Truck Leasing System, "Many of these will be represented at our annual meeting, exchanging their automotive know-how for management hints available to them from 'old time' truck lessors who are the nucleous of the National Truck Leasing System."

### F-M Beloit Promotions

Promotion and reassignment of several executives of Fairbanks, Morse & Co., have been completed. A. Leo West is now vice president and group executive for the company's largest industrial complex at Beloit, Wis. He assumes responsibility for all operations at that location where diesel engines, compressors, large pumps and motors, magnetos, and engine accessories are produced. West will also give support to the newly organized Water Division, which is engaged in the production of sea water de-salting equipment. Other new executive assignments in the Beloit group include C. E. Clausen, vice president-production; H. E. Hanson, vice president-sales; John P. Henebry, vice president and general manager-Water Division; John A. Michelotti, assistant vice president-operations, and C. E. Gross, controller.

### Couplings Bulletin

An expanded line of Dodge Para-flex flexible cushion couplings that absorb vibration and compensate for combinations of shaft misalignment and end float is described in a new 24-page bulletin. Included are a new PX280 coupling with more than twice the torque capacity of the next smaller size, and a new PX90 intermediate size. Both feature the standard tire-shaped flexing element of synthetic tension members bonded together in rubber. Product photographs, engineering drawings and actual installation pictures are included. Other data includes horsepower ratings, dimensions, prices and weights. Ask for bulletin 901B. Dodge Manufacturing Corp., Mishawaka, Ind.

ITS NEW

### Aeroquip Advances Roberts

Promotion of Joseph R. Roberts to the newly created position of director of advertising has been announced by Don T. McKone, executive vice president of Aeroquip Corp. Mr. Roberts was formerly advertising manager, a post he has filled since joining the company in 1954. He will have the responsibility for enlarged corporate advertising and promotional functions.

### Foxboro Holland Plant

The Foxboro Co., Foxboro, Mass., has announced the completion of a new instrument manufacturing and assembly building at the Foxboro (Nederland) N. V. plant in Soest, Holland. The new structure will permit a substantial increase in the production of standard Foxboro instruments supplied to industries in the European Common Market. Production of d/p Cell Transmitters will be expanded along with manufacture of pneumatic panel-type Consotrol instruments, valve motors, and basic temperature and pressure instruments.

## West Coast News

*By* **James Joseph**

ORDERED: by T.I.M.E. Freight, Inc., more than $6 million worth of new line haul equipment, including 21 Kenworth aluminum cabover tractors (K-522s) with Cummins NH engines and 12 GMC cabover DFW-7010s with GMC 6V-71 diesels.

FOR Texas Leasing Co., for use on Texas-Arizona-California routes by Texas-Arizona Motor Freight, Inc., nine Kenworth K-522s with 220 hp diesel engines.

ALL American Nut Co., Downey, Calif. has repowered its 26 ft. Jeffries cruiser with an Osco Ford diesel (100 hp., six cylinders). Sale by Fellows and Stewart shipyard, Terminal Island, Calif.

TO Cascade Pump Co., two Continental natural gas-fueled S-820s (154 hp @ 2070 rpm) for storm water pump station in Artesia, Calif. Sale by Industrial Engine Service, Los Angeles.

NEW 26 ft. cruiser owned by L. L. Clark is being powered with an Osco Ford 100 hp diesel.

TUNA clipper *Southern Pacific* has repowered her work skiff with an Osco Ford marine diesel, 100 hp, with 2½:1 reduction and swinging 26 in. prop.

FOR pump service with San Antonio Water Co., Upland, Calif., a Continental R602 natural gas engine (176 hp @ 2100 rpm).

SOLD: to B J Service Inc., Long Beach, Calif., a Cummins NTRO-335-BI (335 hp @ 2100 rpm) diesel for powering an oil well cementing pump. Sale by Cummins Service & Sales, Los Angeles.

SOLD to Lindwall Boat Works, Santa Barbara, Calif., an Osco Ford diesel (100 hp) for repowering the commercial fishing boat *Little Kay*.

RINGSBY Truck Lines, Inc., has ordered 20 new Peterbilt COE dieselized tractors (Model 282 tilt-cab) designed to haul two 27-ft. high-cube trailers where state overall length maximum is 60-ft.

EMERSON GM Diesel Inc., Seattle, is new distributor for Detroit Diesel Engine Division's line of truck, industrial and marine diesels for western Washington and a section of southern Alaska.

REPOWERING a Michigan 375-A front end loader for Norwalk Asphaltic Concrete Inc., Santa Fe Springs, Calif., is a Cummins V8-350-BI (governed to 320 hp @ 2200 rpm). Shovel has 6-yd. bucket.

**Once again Perfect Circle Piston Rings are the overwhelming choice among winners of Fleet Owner Magazine's annual Maintenance Efficiency Awards. And what is a better test of piston rings than daily fleet use? In an industry where costs are counted in mills per mile, there's little room for second-guessing. Only replacement parts of proved long-run dependability—equipment that will reduce operational costs and increase profits—are acceptable. That's why, year after year, the majority of award-winning fleets rely on PC rings for greater efficiency on the road—less down time in the shop—and more black ink in the books. Prove it yourself—install PC rings in your fleet, too!**

EXCLUSIVE PERFECT CIRCLE USERS AMONG 1961 M.E. AWARD WINNERS • ANDERSON HAULAGE COMPANY, COLUMBUS, OHIO • ARROW COACH LINES, BROWNWOOD, TEXAS • D.C. TRANSIT SYSTEM, INC., WASHINGTON, D.C. • GARY TRANSIT, INC., GARY, INDIANA • GEO. A. HORMEL & COMPANY, FORT DODGE, IOWA • HARRISBURG RAILWAYS COMPANY, HARRISBURG, PENNSYLVANIA • KANSAS CITY TRANSIT, INC., KANSAS CITY, MISSOURI • LOUISVILLE TRANSIT COMPANY, LOUISVILLE, KENTUCKY • ROSE CITY TRANSIT COMPANY, PORTLAND, OREGON • THE CONNECTICUT CO., NEW HAVEN, CONNECTICUT • THE E. KAHNS SONS CO., CINCINNATI, OHIO • WASHINGTON, VIRGINIA, & MARYLAND COACH CO., ARLINGTON, VIRGINIA

AGAIN IN '61— More award-winning fleets use Perfect Circle Piston Rings exclusively than the next 5 brands combined!
PERFECT CIRCLE ...The Rings The "Pros" Prefer!
PISTON RINGS • POWER SERVICE PRODUCTS
HAGERSTOWN, INDIANA • DON MILLS, ONTARIO, CANADA

FOR Burbank, Calif.'s John P. Gilbert's yacht *Five Gs*, two GM series 71-V8s, 228 hp @ 1800 rpm. Sale by Anderson-O'Brien Co., San Pedro, Calif.

THE 36 ft. fishing boat *Vinmar* has been repowered (diesel replacing gasoline) with a GM series 451 marine diesel, 130 hp @ 2800 rpm.

DICK Bolton, Crystaliner Boat Ways, Morro Bay, Calif., has taken delivery of an Osco Ford diesel, 4 cylinder, 68 hp, for his new commercial fishing boat. Sale by Fellows and Stewart, shipyard.

JOHNS-Manville Products Inc., Lompoc, Calif. has repowered a Model 111-M Marion shovel with a Cummins NVH-12-BI (450 hp @ 2100 rpm), working thru Twin Disc converter.

INSTALLED in bait receivers owned by Santa Monica, Calif.'s W.O.W. Bait Co., a Lister-Blackstone SL-1, 2½ kw generator set, directly coupled, and rated 4½ hp.

FOR Bob Smit's 20 ft. lapstrake speed boat, an Osco Ford diesel, 68 hp, sale by Fellows and Stewart.

PIERPOINT Landing has installed in two new 85 ft. sportfishing boats, the *Liberty* and *Freedom*, two (each) 420 hp Caterpillar D-343s (420 hp @ 1800 rpm). Sale by Shepherd Machinery Co., Whittier, Calif.

FOR George Fisher's Harbor City, Calif. based cruiser, a Lister-Blackston SL-4 (20 hp @ 2150 rpm) with MGR 2:1 reduction gearing. Boat is the *Columbia*, and the diesel is for main power. Sale by Bolstad Sales & Service, San Pedro.

## Photoelectric Tachometer

Dayton Safety Tach, a portable self-contained photoelectric tachometer for fast, accurate speed measurement of both rotating and reciprocating machinery, is described in a new bulletin. Entirely self-contained the unit requires no external power source and no mechanical or electrical contact with the machinery whose speed is being checked. The instrument will measure the speed of both constant and changing speed machinery. It utilizes a photoelectric cell that responds to very small changes in illumination. As the cell senses a light change caused by a marker on the moving object, it transmits a signal to a pulse triggered computer, which in turn, counts the rate at which the light changes, averages the rate per minute, and displays the result on a direct reading dial. For a free copy of the bulletin, write to Simonds Worden White Co., 1101 Negley Place, Dayton 7, Ohio. (ITS NEW)

## Standards Conference

Problems confronting air, marine, motor freight and rail transport media in material handling and their potential solution, in some areas, through standardization will be examined during the 12th National Conference on Standards to be held October 10-12 in Houston, Tex. The three-day meeting is sponsored by the American Standards Association and will include sessions devoted to purchasing, data processing, safety, plastics and mobile homes. A special session will be devoted to a discussion of standards as applied by companies, industries, trade and technical associations, the government and those approved by the American Standards Association.

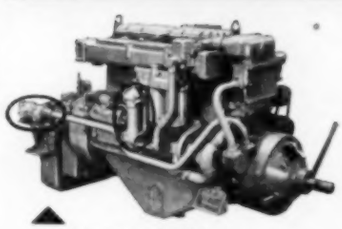
## Regional Manager

Edward B. Capliski has been appointed manager of the New York Regional Branch of the Commercial Sales Division of American Bosch Arma Corp. Mr. Capliski had been assistant manager of the New York Regional Branch for the past two years previous to which he had been a field engineer.

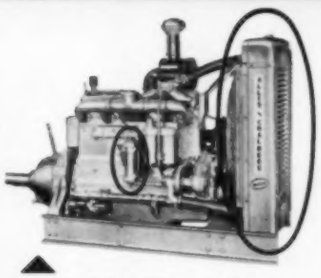

LEADING DIESEL AND GAS ENGINE BUILDERS USE

Young HEAT TRANSFER PRODUCTS

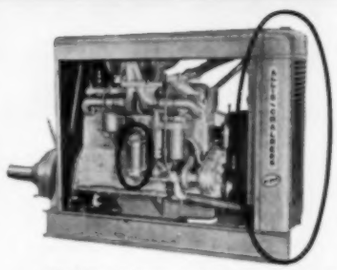
TO MAINTAIN ENGINE EFFICIENCY AND RELIABILITY



Allis-Chalmers uses two Young heat exchangers for cooling lube oil and transmission oil in their line of marine engines.



Young Mono-Weld radiator and oil cooler keeps the Allis-Chalmers 16000 series engines running cool under extreme operating conditions.



The Allis-Chalmers 21000 engine series use Young Mono-Weld radiators and oil coolers to keep them operating at optimum temperatures in a variety of applications.

**MONO-WELD® Heavy Duty Radiator** — Its original and unique features make it one of the most efficient and reliable radiators built to perform under the most rugged conditions. Exclusive Young welded construction and double lockseam tubes increase unit strength 100% ... makes it the most rugged radiator built.

**Transmission Oil Coolers** — For mobile or stationary use. Available in single and multi-pass models. Fixed or removable tube bundles. Special baffles are spaced for maximum heat transfer with minimum pressure drop.

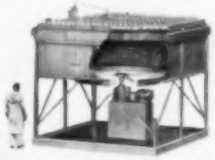
**Oil Coolers** are designed to provide maximum heat transfer with a minimum of space. Tubes and tube sheet high temperature bonded into casting. Gives 10% more surface for given shell and tube diameter.

**YOUNG OFFERS YOU A WIDE RANGE OF STANDARD HEAT TRANSFER PRODUCTS ... *PLUS* the engineering, designing and manufacturing facilities for building equipment to your specifications!**

**Supercharger INTERcoolers AFTERcoolers**

High or low pressure models. They provide considerably reduced temperatures at operating pressures varying from 4 to 30 psi.

**YOUNG Air Cooled Oil Coolers** provide efficient cooling for a wide variety of mobile or stationary power equipment. Patented Young turbulators increase heat transfer 100%.



**HC® Horizontal Core Coolers** feature forced vertical air discharge for cooling water, oil and gases, or for condensing steam and vapors. Compact design, permits space savings and articulated installation of two or more units.

**Young Engine Jacket Water Coolers** feature rugged Mono-Weld® construction. High efficiency fans reduce power cost. Choice of flat or round tube core construction. Fins of aluminum, copper or admiralty.

Young Quality®

YOUNG RADIATORS ARE USED WHERE THE GOING IS TOUGH!

*Write Dept. K-401 for General Catalog No. 160*

YOUNG RADIATOR COMPANY

General Offices: Racine, Wis.

Plants at Racine, Wisconsin and Mattoon, Illinois

## Michigan-Ohio News

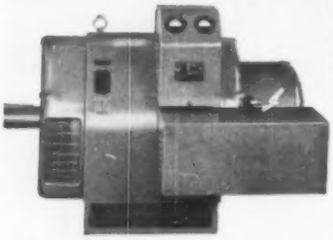
*By* Jim Brown

PENINSULAR Diesel Inc. of Detroit reports the installation of a 4171E GM diesel engine in a Duplex KH truck for Allegan County Road Commission of Allegan, Michigan. The new diesel will replace a gasoline engine.


*Get the latest!*

**A COMPLETELY NEW "PACKAGED" GENERATOR**

**AMP-PAK**



AMP-PAK Generator shown is rated at 187 kva, 1200 rpm, 240/480 volts. AMP-PAK is available in ratings of 75 thru 187 kva at 1800 rpm and 62½ thru 187 kva at 1200 rpm. Three phase, 80% PF, 60 cycles, 50C rise, and 120/208, 240 and 480 volts.

**No exciter . . . No moving parts in the voltage regulator**

AMP-PAK is a compact, revolving field a-c generator with built-in, static excitation system; static voltage regulator; and basic metering and controls conveniently grouped. AMP-PAK is a portable unit, factory assembled, internally connected, and tested.

**No rotating exciter to maintain.** D-C excitation is provided by a heavy duty, long-life, static rectifier.

**No tubes, relays, vibrators to service.** Voltage is regulated by a static, E-M-developed sensing circuit and "magical" magnetic amplifiers.

**Holds voltage "rock-steady"** so your motors, lights, and electronic equipment will work better. The static regulator provides ±2% regulation.

**Starts big motors.** A special, built-in voltage booster transformer stands by to reinforce line voltage when heavy loads are suddenly applied.

**Easy to install.** Needs no switchboard. Just connect load to AMP-PAK thru a suitable line switch.

**Simple to operate.** Has no belts, no "tricky" commutator, no adjustments — anyone can operate AMP-PAK.

*See your nearest E-M Sales Engineer and write the factory for publication PRD-236.*

E-M

**ELECTRIC MACHINERY MFG. COMPANY**
Minneapolis 13, Minnesota

*Largest manufacturer of "Packaged" Generators*

2100-TPA-2154


AN Oliver model 880 Hydro-trencher (½-yd. backhoe) powered by a Hercules diesel engine was recently sold to Frank J. Knight Co. of Centerline, Mich., for utility work throughout Michigan. It was purchased from Cyril J. Burke, Inc. of Detroit.

HOLLOWAY Construction Co. of Livonia, Mich. has recently accepted delivery on their second Michigan model 380 tractor-dozer. The new 'dozer was purchased from Miller Equipment Co. and is powered by a 12V-71 GM diesel engine.

GLOBE Construction Co. of Kalamazoo, Mich. has accepted delivery on two generators mounted in a van trailer. The generators are powered by a model 7125-7200 GM diesel (260 kw) and a model 5025-7101 GM diesel (25 kw). They will be used to provide power for an asphalt plant and were purchased from Peninsular Diesel Inc.

MICHIGAN Bridge Contractors Co. of Livonia, Mich. has a new Northwest model 25 D truck-crane to add to their equipment. The Northwest is powered by a GM 3-71 diesel engine and was purchased from Cyril J. Burke, Inc.

HOLLOWAY Construction Co. of Livonia, Mich. has recently accepted delivery on their fifth Michigan model 280 tractor-dozer powered by a model 8V-71 GM diesel. Sale was made by Miller Equipment Co. of Livonia, Mich.

HARRINGTON Fuel & Dock Co. of Holland, Mich. has accepted delivery on two generator sets powered by model 5025-7101 GM diesel engines (25 kw). The engines were supplied by Peninsular Diesel Inc.

A Pettibone-Mulliken model 125AD (1½-yd.) loader was delivered to Grinolli & DePompoli of Detroit. The new P-M loader is powered by a Hercules diesel and was purchased from Cyril J. Burke, Inc.

STRAITS Aggregates Co. of Oscoda, Mich. has accepted delivery on a Michigan model 175A loader (¾-yd.) powered by a Cummins C-175 diesel. The sale was made by Miller Equipment Co.

E. B. Sand Co. of Warren, Mich. has replaced a gasoline engine in their Unit ¾-yd. crane with a model 3055C GM diesel. Local GM distributor is Peninsular Diesel Inc.

HOLLOWAY Construction of Livonia, Mich. has just ordered their second Michigan model 180 tractor-dozer. The new "180" is powered by a 6V-53 GM diesel and was purchased from Miller Equipment Co.

A Northwest model 41 (1-yd.) pull-shovel powered by a Murphy model 20 diesel engine was recently sold to Grinnolli & DePompoli of Detroit. Sale was made by Cyril J. Burke, Inc.

ST. MARY'S Hospital in Grand Rapids, Mich. has accepted delivery on a new standby generator powered by a model 7163-7200 GM diesel (275 kw). The engine was purchased from Peninsular Diesel Inc.

A gasoline engine was recently replaced in a Reo F-22 truck with a model 5047-7241 GM diesel. The installation was done for Muller Baking Co. of Grand Rapids. Local distributor is Peninsular Diesel Inc.

WARD & Van Nuck of Detroit have replaced a gasoline engine in their P&H Model 255 crane with a model 3055C GM diesel engine. Sale was made by Peninsular Diesel Inc.

JOHN R. Morgan of Detroit has switched from gasoline to diesel with a model 5047-5243 GM diesel. The installation was done in a Ford C-700 truck by Peninsular Diesel Inc.

A GM model 3057C diesel was recently installed in a Michigan 125 loader (replacing gasoline) for Huron Portland Cement of Alpena, Mich. The engine was supplied by Peninsular Diesel Inc.

RODNEY Charbeneau of Mt. Clemens, Mich. has switched to diesel with the installation of a GM 5047-7240 in his Dodge C-700 truck. GM distributor is Peninsular Diesel Inc.

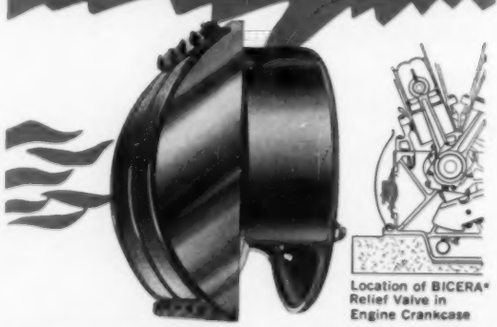
### M-F Brazilian Unit

Massey-Ferguson will soon begin tractor manufacturing in Brazil, it was announced by the Toronto-based farm machinery company. The new manufacturing operation will be undertaken at Sao Paulo by Massey-Ferguson to Brasil in association with the local firm of Vemag, S. A., distributors of M-F products in Brazil since 1946. The tractors to be manufactured will be powered by Perkins diesel engines now being produced by Motores Perkins, S. A., in Brazil. The Perkins group is a subsidiary of Massey-Ferguson Ltd.


**AVAILABLE NOW!** The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 10850 Riverside Dr., North Hollywood, Calif.



"Life Insurance" PROTECTION AGAINST CRANKCASE EXPLOSIONS



Location of BICERA* Relief Valve in Engine Crankcase

An Explosion Relief Valve without a Flame Trap can actually increase danger to operators as even small explosions shoot flames through unprotected Valves. The BICERA* Valve with internal oil-wetted wire gauze trap is six times more effective than valves with external flame traps.

The Patented internal flame trap design combined with rugged "O" Ring type relief valve which eliminates oil, leakage, releases pressure immediately, and reseals quickly, preventing inrush of air . . . result—only Valve made in U.S.A. which does the complete job. BICERA* Valves, widely used abroad since 1957, are approved by Lloyds of London. Three sizes available. Write for Bulletin #10 and recommendations as to BICERA* Valves for your application.

*British Internal Combustion Engine Research. Pat. No. 2863512

**CHOWNING REGULATOR CORP.**
165 Cedar St. Tel: XN 2-2446 Corning 2, N.Y.

# QUARRY USES "RIP & PUSH" OPERATION

*By* ED DENNIS

A UNIQUE brand of limestone mining is being done at the rock quarries of Lansing Rock Co. located north of Brooksville, Fla. Instead of using dynamite, the firm uses a big Caterpillar D8 tractor equipped with three hydraulically operated ripper blades. The company maintains that money spent on dynamite "goes up in smoke with a bang, while the same amount of money spent on good machinery sticks around for awhile."

The work pattern used consists of a 190 hp Caterpillar tractor with three rippers located on the rear, ripping and digging several inches deep into the limestone deposits located on a shelf in the quarry. Then another D8 Caterpillar tractor (D342 engine with 5¼x8 in. bore and stroke), equipped with a dozer blade pushes the rock material over the side of the shelf into the pit where a Bucyrus-Erie 54-B shovel powered by a 300 hp turbocharged six cylinder Cat diesel engine picks up the limerock material with its 2½ yd. bucket and loads it into Mack B61, 14 yd., dieselized dump trucks for transportation to the crusher.

Progress, of course, depends a lot on the amount of rock material the trucks can move per trip, the speed at which they can haul the loads, dump it into the crusher and return to the pit. Here the four Mack dieselized dump trucks play an important part as they complete the three-quarter mile cycle from pit to crusher and return in about four minutes. After the rock is crushed it passes via feeder belts, surge bins and conveyor belts to railroad cars or to stock piles.

To date, downtime on the dieselized part of the equipment has been nil, as maximum rock production at this plant requires maximum diesel engine performance. Each piece of equipment is checked every night and greased and oiled every second night. Lubricating oil and filters are changed every 200 hrs. of operation and, as most of the equipment is only a year or so old, there has been no major mechanical trouble. Every precaution is taken to keep it in "fresh-off-the-assembly-line" condition.

### List of Equipment

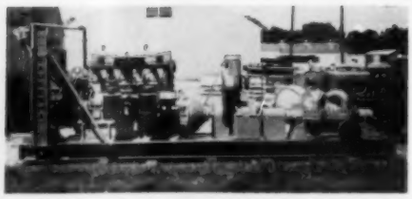
1-D8 Caterpillar tractor with three rippers and a dozer blade
1-D8 Caterpillar dozer
1-Bucyrus-Erie 54 B 2½ yd. shovel with Caterpillar D337 diesel
4-Mack dieselized B61, 14 yd., dump trucks
1-Model 175A Michigan tractor shovel with Cummins diesel
1-Model 275A Michigan tractor shovel with Cummins diesel

**The toughest part of this rip and push type of mining, is done by this D8 Caterpillar 190 hp tractor with the ripper attachments as the three blades dig into the limerock so that the other machines can remove it.**

**The 2½ yd. Bucyrus-Erie 54-B shovel, with a six cylinder, four cycle, turbocharged D337 Caterpillar diesel having a max. hp of 310 at 2000 rpm, shown with one of the four Mack dieselized 14 yd. dump trucks. Daily quarry production is about 3500 tons.**

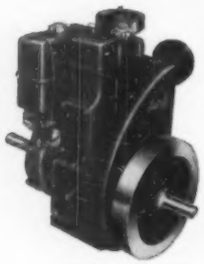
## Waukesha Powers 13 Ton Transfer Pump

A 13-ton oil transfer centrifugal pump driven by a Waukesha model LRZU standard oil field power unit has been installed by Reagan Equipment Co. of New Orleans atop an oil production gathering structure in oil-productive Bay Marchand offshore in the Gulf of Mexico. The unit is mounted on a specially designed skid of galvanized steel which prevents contamination of surrounding waters by waste, in conformity with State Conservation Department regulations. The pump used in this package is a United Centrifugal 4 in. 4-stage heavy duty oil field type horizontal pump. When operating at the selected designed speed of



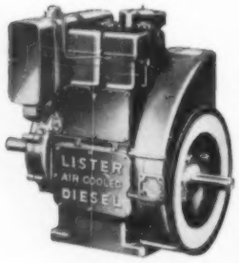
3025 rpm, it will deliver 35,000 bbls/day of crude oil, having a specific gravity of 0.85 and a viscosity of 170 ssu, at the 400 psig. Features of the pump include a heavy steel case, 1113 chrome impellers, 410 chrome hardened rotating wearing parts and ductile ni-resist stationary wearing parts. Prime mover is a Waukesha model LRZU standard oil field power unit running at 1100 rpm. The 312 hp six cylinder engine has a 9⅜ x 8½ in. bore and stroke and 3520 cu. in. displacement. The drive pump operates through a Western Gear Corp. model 115-HS-80 horizontal offset, vertically in-line speed increaser. In the operating area, the engine is cooled by use of a fin and tube radiator. It has an Ingersoll Rand model 20 BM air starter, and Ensign natural gas carburetor, Vortox air cleaners, Bendix low-tension shielded magneto, coils primary and secondary winding and Champion spark plugs. The ignition system is vapor-tight and can be installed where hazardous conditions obtain. The engine is also equipped with a Twin Disc clutch power take off, with a low-speed coupling and a Fast spacer-type high-speed coupling. The unit is installed on a structural steel hot-dip galvanized steel skid equipped with pad-eyes for four-point lift. The skid is designed with galvanized steel drip pan to catch waste. It measures 25 ft. in overall length, 5 ft. 3 in. overall width and 8 ft. in height. A Ren exhaust condensor provides make-up water for the radiator. Oil filters are Winslow full flow type. Instruments include Reliance tachometer, oil pressure, water temperature and fuel pressure gauges. The unit was assembled through the joint efforts of Reagan Equipment Co., area distributor for Waukesha, and a major oil company operating in Bay Marchand.


# AIR-COOLED DIESEL POWER —by Lister



Model SL1
4¼ HP @ 1800 RPM

## A COMPLETE RANGE of AIR-COOLED DIESEL ENGINES from 3½ HP to 72 HP




Model SL2
9½ HP @ 2000 RPM

*Eliminate Winter Worries*

Built-in cold starting for sub-zero temperatures; totally enclosed working parts. No "freeze-ups."

Engineered to suit all types of applications.

Totally enclosed working parts to insure continuous operation even under adverse conditions.

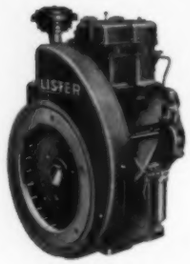
Housings and adaptors to S.A.E. specifications.

Design simplicity reduces maintenance costs.

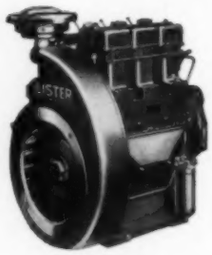
Rugged construction for heavy duties.

Economical operation with low fuel consumption.

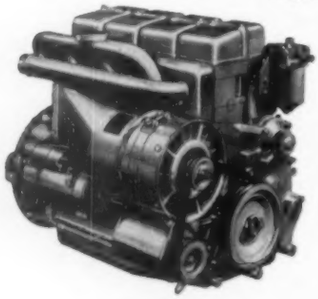
Dependable power for generating sets, pumps, compressors, etc., in oil fields, construction, marine, agriculture, mining, refrigeration, etc.



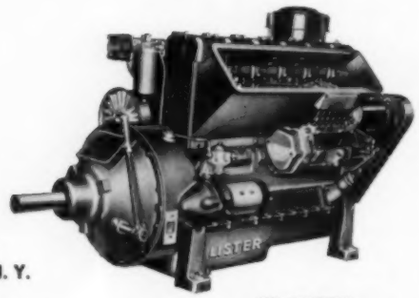

Model HB2
24 HP @ 2000 RPM




Model HB3
36 HP @ 2000 RPM



Model SL4
20 HP @ 2150 RPM




Model HB6
72 HP @ 2000 RPM

**LISTER - BLACKSTONE, INC.**
**42-32 21st Street, Long Island City 1, N. Y.**

*In Canada:*
*Canadian Lister-Blackstone, Ltd., 1921 Eglinton Ave. East, Toronto 13,Ontario*


## New Nozzle Lapping Process

A new diesel injector nozzle lapping process has been introduced by Leslie Hartridge Ltd., London, England, one of the largest manufacturers of diesel test and service equipment. The new Hartridge process is said to reduce nozzle lapping time on an average reclaimable nozzle seat from between ten and twenty minutes to one-half the normal time. Principal element in the new process is the Hartridge Rapidlap, a nozzle lapping machine with a specially-designed lapping head which produces absolute concentricity. It can handle both small and large nozzles up to the 'U' and 'V' size and has high and medium speed spindles providing two lapping speeds. The Rapidlap is mounted on a rotatable base and has a three-position headstock which enables the machine to be swung into a position to accommodate either a right or left handed operator. Pintle nozzles can be serviced as well as all other types, and the machine fits into any nozzle reclamation technique or can be used for any lapping process within the capacity of the unit. Details can be obtained from Diesel Injection Sales & Service, Inc., 1120 E. Brambleton Ave., Norfolk, Va. (ITS NEW)


**AVAILABLE NOW!** The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 10850 Riverside Dr., North Hollywood, Calif.

## Industrial Turbine Sales Manager

R. A. Fletcher

Appointment of Robert A. Fletcher to the newly created post of sales manager—Industrial Gas Turbines for AiResearch Manufacturing Co. of Arizona, a division of The Garrett Corporation, has been announced. Mr. Fletcher joined AiResearch in 1959 after having been sales manager of Solar Aircraft Co. of Des Moines, Iowa. As supervisor of Fabrication Control at AiResearch Phoenix he was instrumental in setting up a new electronic production control system. In making the announcement J. J. O'Brien, division manager, pointed out that this is the second new appointment in the AiResearch industrial gas turbine field in the past four months. Previously, James T. Shore was promoted to program manager of AiResearch industrial gas turbines.

## F-M Beloit Marketing Director

S. K. Howard

Sheldon K. Howard has been named to the new position of director of marketing of the Beloit (Wis.) Group of Fairbanks, Morse & Co. Mr. Howard, manager of the company's diesel engine sales for the last two years, also will guide the marketing of other products made at Beloit— magnetos and engine accessories, compressors, large pumps and large electric motors. He managed F-M's diesel sales in Atlanta from 1951 to 1959 and before that was a diesel sales engineer in the Boston territory.

## Dana Promotions

C. C. Dybvig, vice president-marketing of Dana Corporation, has announced the promotion of W. H. Schomburg, Jr. to the position of general sales manager. Mr. Schomburg has been assistant general sales manager since 1959. John P. Henson, former sales manager of Dana's Universal Joint Division, has been named assistant general sales manager. Mr. Schomburg joined Dana Corporation

W. H. Schomburg

J. P. Henson

in 1945. In 1953 he became product sales manager for clutches and universal joints, then a year later was named product sales manager, universal joints exclusively. Mr. Henson joined Dana in 1959 as sales engineer handling several major automotive accounts. In March of 1960 he was appointed sales manager of Dana's Universal Joint Division.

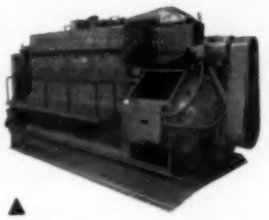
Atlas Missile as it clears the pad.

Engine exhaust heat, recovered by Vapor Phase® Waste Heat Recovery Silencers on White Diesels, is utilized in the latest design of ICBM sites. Cost of operation is reduced substantially by using this energy in various ways to supplement generated power.

In other applications, engine heat from jacket water and exhaust is recovered for space heating, product heating and with absorption refrigeration for air conditioning.

In addition to these advantages, Vapor Phase systems permit the use of cheaper fuel. Engine wear is reduced and you can lengthen the time between overhauls.

Wherever engines are used, Vapor Phase® can improve efficiency and add economy.



▲ White Superior Engine-Generator Model 40 SX-8 used at Atlas Missile Bases.

Vapor Phase Exhaust Waste Heat Recovery Silencer designed for use with the Superior Engine-Generators used by the Air Force at Missile sites. ▶

E C VAPOR PHASE

ENGINEERING CONTROLS, Inc.

611 E. Marceau • St. Louis 11, Mo.

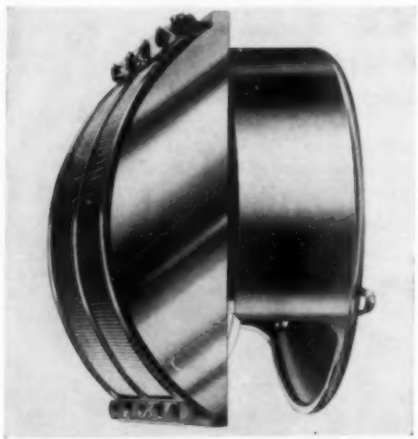
## Single Stage Compressor

A new single stage centrifugal compressor, built for high temperature and/or high pressure applications has been introduced by Roots-Connersville Blower. Designated model HTP, the unit is designed for applications requiring working pressures from 50 to 500 psig and operating temperatures up to 800° F. Models are available with inlet capacities from 500 to 5000 cfm. Because of its high speed characteristics and the wide variety of seals with which it can be fitted, the model HTP is suited for many applications in the petroleum, chemical, petrochemical and atomic industries. Basically a constant pressure, variable volume machine, the HTP has a wide

range of stable operation. The compressor is driven by a gas turbine through a speed increasing gear. To simplify installation, it is mounted complete with driver and accessories on a heavy, one-piece fabricated steel baseplate. Further data can be obtained from Roots-Connersville Blower, Division of Dresser Industries, Inc., 900 W. Mount St., Connersville, Ind. ITS NEW

## New Crankcase Explosion Relief Valve

The British Internal Combustion Engine Research Association has licensed the Chowning Regulator Corp. of Corning, N. Y. to produce in the U.S.A. its latest design of crankcase explosion relief valves. Design of this valve is based on the results of considerable investigation by BICERA that proved that the internal oil-wetted wire gauze design is one of the most satisfactory types of flame trap. With heat absorption substantially greater due to the more even distribution of the gas flow through the gauze. It has also been demonstrated that the cooling capacity of the gauze is roughly doubled when it is oil-wetted. In most cases this is conveniently effected by the oil mist conditions normally prevailing in the crankcase, or by oil spray from connecting rod bearings. The operating principle of the Bicera relief valve is that in event of a pressure of more than 2 p.s.i. being attained in the crankcase of an engine or compressor, the gas finds its exit to atmosphere via (a) 6 layers of oil-wetted gauze (2 coarse 2 medium, and 2 fine), (b) the opening of a spring-loaded circular member with an air seal around its periphery and an oil seal around its guide on the spindle and (c) a deflector cowl which directs the gas downwards, not across the gangway beside the engine. By these means a flame is quenched and force dissipated and directed. When pressure within the crankcase has fallen to normal the coil spring returns the circular member to its "closed" position; this not only means the end of outward motion of gas from within the crankcase but the very vital safeguard of no air admission to the crankcase is achieved. Explosions of mixtures of oil mist and air produce pressures similar to those of mixtures of hydrocarbon gases and air. The same relief areas are therefore specified for diesel engines as for gas engines or dual-fuel engines. After exhaustive tests of crankcases of robust de-



sign it is recommended that for complete protection that relief area be provided at the rate of 3 sq. in. of relief valve area to each foot of crankcase volume. The requirements of crankcase relief areas are the same for two and four cycle engines. Chowning is manufacturing these valves in 6, 10, and 12¾ in. sizes which gives an effective area through the valve of 28, 78, and 128 sq. in. respectively. For further information write for Bulletin #10, Chowning Regulator Corp., Corning, N.Y. ITS NEW

CUT FUEL COSTS
BILLS
NOISE CONTROL IS OUR BUSINESS
There is a Maxim Silencer for every industrial, marine or special purpose requirement.

UTILIZE WASTED EXHAUST HEAT!

**Maxim Heat Recovery Silencers can save 1,000 or more BTU per hp/hour that you are now wasting through engine exhausts.**

Many industrial plants, power stations and petro-chemical installations produce enough BTU's in wasted exhaust heat to handle a large part or all of their heat requirements. Maxim Waste Heat Recovery Silencers are especially designed to turn this BTU loss into usable energy as steam or hot water.

There are valuable heat recovery possibilities in most industrial plants. For these applications or wherever there is a need to control noise or sparks, there is a Maxim Silencer designed to do an efficient job for you. Look around your plant or field installation and see if you're paying high fuel bills and wasting more heat in exhaust than you're buying in heating fuel.

*A Maxim engineer is ready to work with you on your heat recovery and noise control projects . . . write or call today!*

MAXIM BEAIRD DIVISION

THE J. B. BEAIRD COMPANY
A subsidiary of American Machine & Foundry Company
Shreveport, Louisiana

*Sales agents in all principal cities and in many foreign countries.*

POSITIVE
ENGINE
SHUTDOWN
in the event
of trouble!

O-27
User $9.00

OIL PRESSURE
SAFETY SWITCH GAUGE*

Automatically stops engine if oil pressure fails. Mount on instrument panel or screw into oil line. Visible contacts and pressure gauge in one instrument.

SR-21
User $9.00

WATER TEMPERATURE
SAFETY SWITCH GAUGE*

Instantly shuts down engine when overheating. Mount on instrument panel or screw into water jacket.

*Also available with dual contacts to warn before shutdown.

(For snap-action operation, add our Magnetic Switch.)

MV-7199
User
$29.50

FOR DIESELS, ADD:
SAFETY FUEL SHUT-OFF

Valve is manually latched open—electrically tripped. Stops engine when oil or water safety switches operate.

- **One instrument is a safety switch and a gauge . . . Does two jobs.**
- **Gives visual proof it's operating.**
- **Simplifies installation and inventory.**

*At your engine dealers or write:*

MURPHY

FRANK W. MURPHY MANUFACTURER, INC.
P.O. BOX 4011
RANCH ACRES STATION
TULSA, OKLAHOMA

MURPHY SAFETY SWITCH OF CALIFORNIA
11812 Davenport Road • Los Alamitos, Calif.

## Joins Interstate Diesel

E. T. Syvertsen

Mr. A. J. Buescher, president of Interstate Diesel Service, Inc., remanufacturer of General Motors injectors and fuel pumps, has announced appointment of E. T. (Jim) Syvertsen as director of marketing for the company. Mr. Syvertsen was formerly general manager, Replacement Division of Thompson Ramo Wooldridge, Cleveland. He has served on various national trade committees such as the board of directors of National Standard Parts Association prior to its merger into Automotive Service Industries Association.

## Dana Marketing V.P.

C. C. Dybvig

Appointment of C. C. Dybvig to the newly created position of vice president of marketing for the Dana Corp. has been announced. Mr. Dybvig joined Dana in 1954 as general sales manager and in 1958 was elected vice president—sales. In his new position Mr. Dybvig will continue with his present sales responsibilities as well as the coordination of sales for Dana's Detroit, Con-Vel, and Transmission and Gear Divisions. Mr. Dybvig served on the Detroit Section Governing Board of the S.A.E. for seven years prior to his term as chairman of the Section (1956-57). He is a member of the Engineering Society of Toledo.

## 1100 HP Saturn Ordered by Phillips

Phillips Pipeline Co., Bartlesville, Okla., has ordered a Solar Saturn 1100 hp gas turbine engine to be used with a liquid products pump in its pipeline operations. The engine, a two-shaft, diesel-fuel burning version of the Saturn engine, will be uesd to boost pressures at various location sites. A new type Carter pump will be driven by the turbine. This application is a departure from standard units and reduces the overall length of the pumping package to 98 inches with increased portability for remote location operations. The Saturn engine, coupled to the pump, will deliver 1900 gpm at a 2500 ft. head. The new unit will be used to pump butane, propane and other liquid products. In a similar application, Okan Pipeline Co. is currently operating a Saturn turbine-powered petroleum pump on its pipeline from southwestern Kansas to Tulsa.

## Double-duty Tachograph

A new tachograph being marketed by Argo Instruments Corp. indicates both engine speed and road speed, and records the data on both sides of a single chart. The new model TCO 14-2 was put to six months of intensive testing on both common carriers and private fleets. It provides a continuous, closed and tamper-proof record of vehicle operation. It records rpm's, mph's, stop and go, and the exact distances traveled. It guards against lugging, over-revving, and driving downhill in neutral. The dial design provides easy reading

for the driver. Further information and descriptive literature may be obtained by writing Argo Instruments Corp., 613 W. 46th St., New York City 36, N. Y. (ITS NEW)

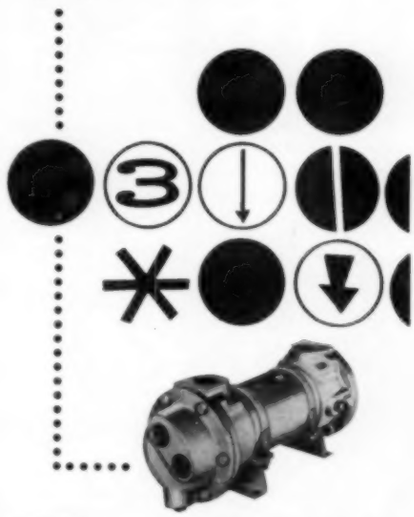
**A SALEMAKER**
**for Your Marine Engines**

Marine Sales Engineer 15 years experience in every trade contact from Maine to Florida for Diesel and Gasoline Engines and Propellers to 2000 h.p. Top Sales Record to distributors, builders, owners, operators, in industrial, commercial, fishing and pleasure craft. Box No. 102, DIESEL AND GAS ENGINE PROGRESS, 1701 W. Wisconsin Ave., Milwaukee 3, Wis.

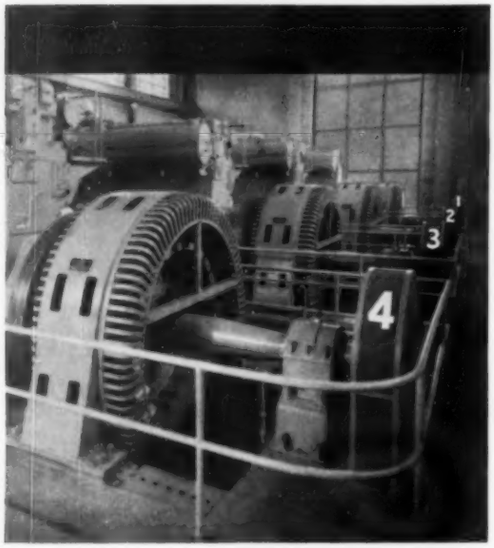
PERFEX

*Presents . . .*

Model B PERFEXCHANGER, a standard high performance shell and tube exchanger, inexpensive and ruggedly built to solve your heat transfer problems.



PERFEX CORPORATION
Heat Transfer Products
500 West Oklahoma Avenue, Milwaukee, Wisconsin



# Mill Creek Adds FOURTH IDEAL GENERATOR!

Cincinnati's new Mill Creek Sewage Works—one of the nation's finest—has recently installed the fourth Ideal 1350 KW A.C. generator, boosting plant capacity to 120,000,000 GPD.

Designed for optimum efficiency in producing electrical power, Mill Creek incorporates a total of 4 Ideal, 1350 KW, 4160 volt A.C. generators that supply the sole power for this station's pumping, comminution, flocculation, digestion and building lighting.

Ideal low and high speed A.C. generators, from 10 to 10,000 KW, are designed and engineered to meet your most exacting requirements. A nation-wide organization is at your service to help you with the planning and application of your next power project.

*For complete information call your nearest Ideal Sales Office or write for Bulletin 510, Low Speed Generators and/or Bulletin 505, High Speed Generators.*

The IDEAL ELECTRIC AND MANUFACTURING COMPANY
614 East First Street Mansfield 4, Ohio, U.S.A.
GENERATORS, MOTORS AND CONTROLS

## Florida Diesel News

*By* Ed Dennis

L. C. Ringhaver, president of Ring Power Corp., St. Augustine, has been appointed dealer for the Caterpillar line of marine, truck and generator engines for the northern part of Florida and will open branches in the Fort Myers and Tampa areas.

*BIMINI Express*, a new 55 ft., 48 passenger vessel plies between Miami and Bimini, Bahamas making the trip in two hours. It is powered by a pair of General Motors 12V-71 diesels each developing 504 hp at 2300 rpm.

A Lister-Blackstone diesel was installed in Frank Murphy's new sailboat, the *Sinbad*. The model SL-2 has a $3\frac{3}{16}$x$3\frac{1}{2}$ in. bore and stroke, develops 12 hp at 1800 rpm, and was supplied by Shelley Tractor & Equipment Co. of Miami.

GILDEMEISTER and Camp of Chiloe Island, Chile, S. A. bought four 619-C Caterpillar tractor scrapers. The turbocharged and aftercooled Cat diesels develop 250 flywheel hp at 1900 rpm. Also included were two D8 Caterpillar dozer tractors shipped aboard the *M. V. Rover* of the West India Shipping Co., Mia.

SYMONETTE, Ltd. of Nassau, received from Florida Georgia Tractor Co., Miami, a TD-20 International crawler tractor with a 134 hp six cyl. International diesel plus a TD-25 dozer powered by a turbocharged D-817 International, 230 net hp diesel.

THE *M. V. Shiqma*, a 350 ft. freighter of the Zim-Isael Line stopped in Miami on its maiden voyage to Venezuela. A Fiat diesel rated 4100 hp at 130 rpm gives the vessel a speed of 14.2 knots while three six cyl. M.A.N. diesels drive 225 kva Thrige ac generators.

FOR the island of San Salvador, a D311 30 kw Caterpillar diesel generating set for prime power. The set is powered by a Cat D311 series H diesel (50 cont hp); for San Salvador Enterprise and engineered by Shelley Tractor & Equipment Co. of Miami.

A six cylinder turbocharged Cummins model NRT-6I rated 300 hp powers the new Hough 120 payloader tractor shovel that R. H. Wright Construction Co. received from Florida Georgia Tractor Co.

THE recently acquired, *New Providence*, a 140 ft. Miami-Nassau freighter, owned by Interinsular Mails Ltd., is powered by a pair of General Motors 6-268-A diesel engines, 500 hp each, plus a GM 3-268, 100 kw dieselized generating set.

UP at Brooksville, the W. P. McDonald Corp. had their Bucyrus-Erie dragline repowered with a GM 3-71 diesel and a similar model went into a 125 Michigan payloader for Cone Bros. of Tampa. The diesels are rated 72 cont hp at 1800 rpm and came from the Jacksonville Br. of Detroit Diesel Div., G. M. C.

WILLIAM Kelly of Barbuda, an island in the Leeward Islands, received a 42 ft. Krogen designed motor sailer from Hong Kong. The teak constructed vessel is powered by a 96 hp six cyl. Ford diesel with Borg Warner 2.5:1 r & r gears and a 28x20 three blade Columbian propeller for a speed of nine knots.

UP at Jacksonville, the Gibbs Corp. constructed several 76x22x2 ft. buoy tender barges to be used on inland rivers by the Coast Guard. The three ton derricks are powered by model D320 Caterpillar diesels each rated 100 cont hp.

TO carry U. S. mail on the Tampa-Orlando run, the Union Truck Terminal Co. of Jacksonville, had their Mack B-142 hiway tractor repowered with a C-160 Cummins diesel rated 160 hp at 2400 rpm, at the shops of Jacksonville Br. of Cummins Sales.

TO be used on the Island of St. Martin for construction work by A. Van de Kwast Construction Co., two 5 kw generating sets powered by model SL-2 Lister Blackstone diesels developing 12 hp at 1800 rpm, from Shelley Tractor & Equipment Co. of Miami.

THE Gahagan Dredging Co. of Tampa installed a model 4-53 GM diesel, developing 85 cont hp at 2200 rpm with Borg Warner 3:1 r & r gears, in a 30 ft. dredge tender boat. The Jacksonville Br. of GM supplied the diesel.

CAPELETTI Bros., doing construction work in Dade County, has received from Florida-Georgia Tractor Co. several International Harvester crawler tractors among which are a TD-15 with a I-HD-554 six cyl. 105 hp diesel, a TD-9 with a 71 hp diesel and a TD-24 dozer.

A 250 kw SRSE Caterpillar diesel generating set powered by a D343-ATA Cat diesel for standby and during peak load demand periods at the Harold Kendel packing house in Goulds from Shelley Tractor & Equipment-Miami.

JAXON Construction Co. of Jacksonville, received a GM 6-71 diesel rated 142 cont hp, to power a flo-fan in a portable Pugmill asphalt mixer via a power take-off and V belts.

### C-B Products Bulletin

The complete line of Cooper-Bessemer Corp. engine and motor driven compressors, power engines, expansion engines, industrial jet-powered gas turbines, and En-Tronic Control systems is presented in a new 14 page, four-color bulletin, "Compression and Power", just released. The bulletin features Cooper-Bessemer products are utilized in gas transmission, power plants, gas field gathering, petrochemical processing, chemical processing, railroads, marine applications, laboratories and industrial air applications. Listed, in addition to Cooper-Bessemer branch and subsidiary offices, are the company's warehouse and engineering services. For a copy write The Cooper-Bessemer Corp., Mt. Vernon, Ohio. (ITS NEW)

### Speech Copies Available

Copies of a booklet containing an address, "The Challenge of the Coming Ten Years in Trucking," presented to the Western Highway Institute by J. Irwin Miller, chairman of the board, Cummins Engine Co., Inc. are available. Mr. Miller offers a challenge to the trucking industry—the challenge that present operating methods may not be good enough in the coming decade. The trucking industry must muster all the vitality and imagination available to meet its competition in the years ahead, he maintains. Copies may be obtained from the company at Columbus, Ind.

### Compressor Valves Booklet

Operation and importance of valves in modern reciprocating compressors are described in a new 44-page booklet, "Questions and Answers about Valving," released by Ingersoll-Rand Co. The booklet details the demands made on valves and their function in a compressor. Since valves must open and close up to 60,000 times per hour, they are subjected to almost every type of destructive force during their operation. The booklet traces the evolution of valving from the mechanically-operated intake valves and heavy poppet discharge valves of the 19th century to modern high speed, air-cushioned valves. For copies of this booklet, write Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y., and refer to Form 3222. (ITS NEW)

### Young California Agents

The Young Radiator Co., Racine, Wisc. announced appointment of the Frost Engineering Service Co. as representative for their heat exchanger and industrial and oil field division, in the southern California territory. The Frost Co. will succeed Flournoy & Everett Inc., who have represented Young Radiator for more than two decades and who are now withdrawing from business. Frost's office is at Huntington Park, Calif.; an associate office is located at San Francisco. The Frost organization is headed by E. Vernon Frost, who has been active in professional and technical societies in the area and brings to the Young Radiator 12 years of experience in the Southern California oil and gas industry. He will be identified with Young horizontal coolers and condensers, evaporative coolers, jacket water coolers, shell and tube heat exchangers, and air cooled oil coolers. The San Francisco office is headed by Donald L. Bracken.


BRIGGS OFFERS YOU, FREE, A COMPLETE FILE SIZE DIESEL CATALOG COVERING ALMOST EVERY TYPE INSTALLATION IN THE DIESEL FIELD

**A BIG HELP in writing specifications, a handy reference in planning and maintaining any type installation where diesels are used . . . in fact, a good source of diesel information that you can use day in and day out. Send for your copy today; no obligation.**

Briggs — FUEL AND LUBE OIL FILTERS
FILTER/SEPARATORS

THE BRIGGS FILTRATION CO. DEPT. 397
WASHINGTON 16, D. C.
YES! At no cost or obligation, send me your Above Manual.
Name .....
Company .....
Address .....

How to STRETCH

a drop of oil...

Manzel force-feed lubricators squeeze the full potential out of every drop of oil you purchase. Model "94", for example, pumps against pressures up to 3,000 pounds, handling any grade of oil from the lightest mineral oil to the heaviest cylinder stock with the same regularity. Model "94" starts, stops, speeds up and slows down in synchronization with your machinery. Every change in engine speed brings a corresponding change in the amount of oil delivered. For details on our whole line of *responsive, responsible* lubricators, write for our catalog. Manzel, 253 Babcock Street, Buffalo 10, New York. For the most efficient lubrication,

ask the man from

A UNIT OF HOUDAILLE INDUSTRIES, INC.

Manzel

SPECIALISTS IN LUBRICATORS AND METERING PUMPS SINCE 1898

Don't Let
"COUPLING ITIS"

ROB
Your Machines
of CONTINUOUS
PEAK PERFORMANCE

SPECIFY THOMAS
FLEXIBLE COUPLINGS

Like a THIEF in the NIGHT an inferior coupling causes wear and damage to your machines—resulting in high maintenance costs and costly shut-downs.

Troublesome maintenance problems and down time are eliminated when you specify Thomas "All-Metal" Flexible Couplings to protect your equipment and extend the life of your machines.

UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:

- Freedom from Backlash
- Torsional Rigidity • Free End Float
- Smooth Continuous Drive with Constant Rotational Velocity
- Visual Inspection while in Operation
- Original Balance for Life
- Unaffected by High or Low Temperatures
- No Lubrication • No Wearing Parts
- No Maintenance

*Write for our New Engineering Catalog 60*

THOMAS FLEXIBLE
COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

INDUSTRIAL COUPLINGS
Compressor Drives
Pump Drives

DIESEL ENGINE COUPLINGS
Main Drives
Auxiliary Drives

MARINE COUPLINGS
Main Drives
Auxiliary Drives

THOMAS
FLEXIBLE COUPLINGS

## ADVERTISERS' INDEX


Air Maze Division, Rockwell-Stanlard Corp. ..... 5
AiResearch Ind. Division, The Garrett Corporation ..... 1
AiResearch Mfg. Division, The Garrett Corporation ..... 48
Alco Products, Inc. ..... 9
Allis-Chalmers Manufacturing Co. ..... 11
Alnor Instrument Co., Division Illinois Testing Laboratories, Inc. ..... 50
American Bosch Arma Corp. ..... 51
Beaird Company, Inc., The J. B. A Subsidiary of AMF ..... 60
Bosch Corporation, Robert ..... 10
Briggs Filtration Company ..... 63
C. A. V. Ltd. ..... 16
Caterpillar Tractor Company Engine Division ..... 4
Chowning Regulator Corporation ..... 56
Cities Service Oil Company ..... 8
Cook, Company C. Lee ..... 6
Cooper-Bessemer Corporation ..... Fourth Cover
Curtiss-Wright Corporation Marquette Division ..... 14
Diesel and Gas Engine Catalog ..... 15
Electric Machinery Mfg. Co. ..... 56
Engineering Controls, Inc. ..... 59
Garrett Corporation, The AiResearch Ind. Division ..... 1
AiResearch Mfg. Division ..... 48
General Motors Corporation Harrison Radiator Division ..... 2
Gould-National Batteries, Inc. Engine Parts Division ..... 52, 53
Harrison Radiator Division General Motors Corporation ..... 2
Houdaille Industries, Inc. Manzel Division ..... 63
Ideal Electric & Mfg. Co. ..... 62
Illinois Testing Laboratories, Inc., Alnor Instrument Co., Division ..... 50
Interstate Diesel Service, Inc. ..... 49
Lister-Blackstone, Inc. ..... 58
M-C-M Machine Works Co. ..... 64
Manzel Division, Houdaille Industries, Inc. ..... 63
Marquette Division, Curtiss-Wright Corporation ..... 14
Maxim Silencer Division, Beaird—AMF ..... 60
Murphy Manufacturer, Inc., Frank W. ..... 61
Perfect Circle Corporation ..... 54
Perfex Corporation ..... 61
Purolator Products, Inc. ..... 13
Rockwell-Standard Corp., Air Maze Division ..... 5
Transmission & Axle Division ..... 7
Sealed Power Corporation ..... 12
Sebastian Diesel Equipment Co. ..... 64
Spray Products Corporation ..... 64
Standard Oil Co., of California ..... Third Cover
Texaco, Inc. ..... Second Cover
Thomas Flexible Coupling Co. ..... 64
Yates-American Machine Co. ..... 49
Young Radiator Company ..... 55


THE ORIGINAL SPRAY STARTING FLUID*

- Starts diesel and gasoline engines (from the smallest to the largest) down to 65° F. below zero • Starts in seconds • Excellent in humid weather too • Millions of cans sold • See your automotive jobber

*The inventors of spray starting fluid. Patent No. 2,948,595

Ask for the can with the "balky donkey" trademark

SPRAY PRODUCTS CORPORATION
P.O. Box 1988 • Camden 1, N.J.

WANTED TO BUY

Old or new stationary diesel, dual fuel or gas engines, with or without generators.

FOR SALE

New and used diesel, dual fuel or gas engines, parts, cylinders, heads, pistons, pins, rings, bearings and crankshafts etc.

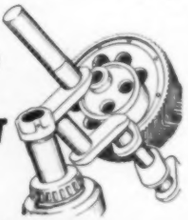
NOW ON HAND

Fairbanks-Morse, all models, 32 VA, 32 E, 33 M, 33 D, 33 E, 33 FD, 31A8½. Worthington dual fuel, Nordberg, DeLavergne, Buckeye, *McIntosh-Seymour, Fulton dual fuel. From 80 HP to 2120 HP. Many others.

Oldest stationary diesel supply house in the country.

SEBASTIAN DIESEL
EQUIPMENT COMPANY
Joplin, Missouri
Phone MA3-3300 P.O. Box 258

for all wearing surfaces where
FREQUENT
REPLACEMENT
is required



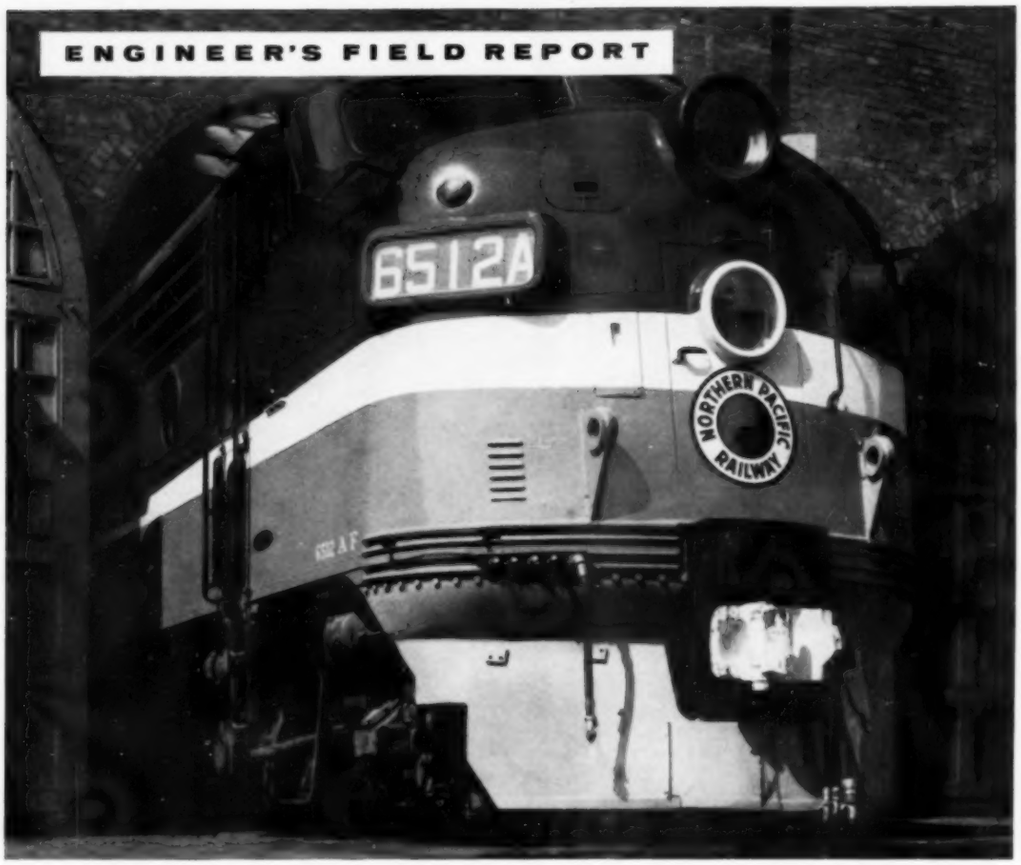
INSIST ON M-C-M
chrome plating

Our customers tell us they have never seen a better job of Hard Chroming. We can prove it to you, too!

ULTRA-HARD CHROME

SEE OR CALL US NOW!

M-C-M MACHINE WORKS CO.
901 S. E. 29th P. O. Box 4485
Ph. MI 7-2449 • Oklahoma City, Okla.




# RPM DELO Oil cuts maintenance costs for...NORTHERN PACIFIC

The big diesels of Northern Pacific Railway are working on their second million miles of rugged service.

They roll over the "Main Street of the Northwest" from the Twin Cities of Minneapolis-St. Paul to Seattle across six western states — through dust, rain, snow, and extreme temperatures. RPM DELO R.R. Special helps keep them rolling.

**Northern Pacific's** mechanical department has cut down-time on diesel locomotives by using RPM DELO Oil. Routine inspections prove that engine parts remain cleaner, show less wear.

**Longer service life,** lower maintenance costs are the usual results with "RPM DELO." That's why Northern Pacific like many major Western Railroads relies on this special compounded oil.

**Constant research,** both independently and in cooperation with forward-looking railroads, has kept "RPM DELO" ahead of diesel engine design and use.

**Today, a complete family of RPM DELO Oils gives railroad users a choice of lubricants for various engine designs, operating conditions and fuel characteristics. Like more information? Just call your local representative, or write:**

RPM DELO

**STANDARD OIL COMPANY OF CALIFORNIA,** San Francisco 20 • **STANDARD OIL COMPANY OF TEXAS,** El Paso
**CALIFORNIA OIL COMPANY,** Perth Amboy, New Jersey - Denver, Colorado

TRADEMARK "RPM DELO" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

# Announcing new diesel engine with less weight per horsepower

For a truly heavy-duty engine, the new KSV provides unusually high horsepower-to-weight ratio, introducing unusual economies in all kinds of stationary and marine services. Shown above on test, this new Cooper-Bessemer 4-cycle engine has proved extremely rugged in continuous operation. It has completed two years of development testing and is now available in 12 and 16 cylinder designs, in spark-ignited gas, diesel, dual-fuel and tri-fuel types . . . for 2960-4280 bhp, 450-514 rpm service.

The high horsepower-to-weight advantage of the KSV results from unique design features including large bore-stroke ratio and short pistons, with relatively high rpm.

Call the nearest office for further information or write The Cooper-Bessemer Corporation, Mt. Vernon, Ohio.

Cooper Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINES: GAS - DIESEL - DUAL FUEL
JET-POWERED GAS TURBINES

V

O

2

1